RAILROAD GAZETTE

SATURDAY, AUGUST 29, 1874.

CATECHISM OF THE LOCOMOTIVE.

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PART XXI.

DIFFERENT KINDS OF LOCOMOTIVES.

QUESTION 417. *Into what classes may locomotives be divided conveniently?*

Answer. 1. Locomotives for "switching," "shunting" or "drilling" service, that is, for transferring cars from one place to another at stations; 2, for freight traffic; 3, for ordinary passenger traffic, and 4, for suburban or metropolitan railroads, where a great many light trains are run.

QUESTION 418. *What kinds of locomotives are used in this country for switching cars at stations?*

Answer. Four-wheeled locomotives similar to that shown in Plate 12. In some cases they are made with six driving-wheels. Engines like that shown in Plate 12 have separate tenders, but they are sometimes made so as to carry the water tank and fuel on the locomotive itself, as shown in fig. 220, and are then called tank locomotives.

QUESTION 419. *Why are locomotives of this kind used for switching?*

Answer. Because in such service it is constantly necessary to start trains, many of which are very heavy, and therefore a great deal of adhesion is needed. For this reason the whole weight of the locomotive and in the case of tank locomotives that of the water and fuel is placed on the driving-wheels. It is also necessary for such locomotives to run over curves of very short radius and into switches whose angle with the main track is very great, and therefore in order that they may do this and remain on the track, their wheel-bases must be very short, and consequently the wheels are all placed between the smoke-box and fire-box.

QUESTION 420. *Why are such locomotives not suited for general traffic?*

Answer. Owing to the shortness of their wheel-bases they became very unsteady at high speeds, and acquire a pitching motion, similar to that of a horse-car when running rapidly over a rough track. This unsteadiness not only becomes very uncomfortable to the men who run the locomotive, but there is danger of the engine running off the track. As nearly all switching is done at very slow speeds, it is not so objectionable for that service as it would be on the "open road"* at high speeds.

QUESTION 421. *What kinds of locomotives are used for freight service?*

Answer. The greater part of the freight service of this country is performed by locomotives like that selected for the illustrations of these articles, and represented in figs. 40, 41 and 42. Such locomotives have been called "American" locomotives because they first originated in this country and are now more generally used here than anywhere else. Side elevations of locomotives of this kind built by the Baldwin Locomotive Works, the Grant Locomotive Works, the Danforth Locomotive and Machine Company, the Mason Machine Works and the Hinkley Locomotive Works are represented in plates 1, 2, 6, 9 and 10.† Such locomotives have been described in the preceding pages.

QUESTION 422. *What are the dimensions of such engines?*

Answer. The principal dimensions of the engines illustrated are given in the table at the end of this article,‡ but locomotives of this plan are built of much smaller and also of larger sizes than those represented by the engravings. In some cases such locomotives do not weigh more than 35 or 36,000 lbs., with cylinders from 8 to 12 in. in diameter. In other cases they weigh as much as 66,000 lbs., with cylinders 17 or 18 in. in diameter. The wheels vary from 4 to 6 feet in diameter, but the most common sizes are 4½ and 5 feet.

‡ We are obliged to defer the publication of this table until next week.

QUESTION 423. *When it is desirable to pull heavier loads than is possible with the adhesive weight that can be placed on four driving-wheels what is done?*

Answer. One or more pairs of driving-wheels are added, as in the ten-wheeled locomotive represented in Plate 4, the "Mogul" engine, Plate 3, and the "Consolidation" engine, Plate 8. The ten-wheeled locomotive, it will be seen, is similar in construction to an ordinary American locomotive, excepting that it has another pair of driving-wheels in front of the main driving-wheels. It will be seen, however, that it is necessary to keep these close to the latter, because if they are brought further forward they will be too near the back truck wheels. For this reason a truck consisting of a single pair of wheels placed in front of the cylinders, as represented in Plates 3 and 8, is now much used. The front driving-wheels are then placed further forward, and thus bear a larger proportion of weight than they do in locomotives like that shown in Plate 4.

* The term "*open road*" is a literal translation from the German, for which there is no corresponding English term, and means the road between stations where trains run fast.

† Plates 1, 2, 3 and 4 were published in the GAZETTE of April 18; plates 5, 6, 7 and 8 in that of July 11: plates 9, 10, 11 and 12 August 15, and plates 13, 14, 15, 16 and 17 with this number.

QUESTION 424. *How are trucks with a single pair of wheels constructed?*

Answer. The truck frame is extended some distance behind the truck axle, as shown in fig. 221, and the center-pin, *a*, about which it vibrates, is placed at the back end. The weight of the locomotive, or that portion to be carried on the truck, is then made to rest over the center of the axle, but in such a way that it can move laterally or crosswise over the track.

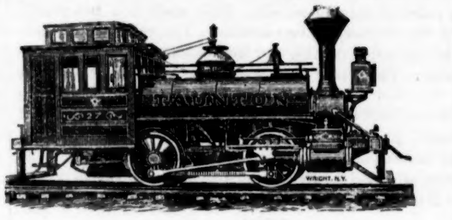

Fig. 220.

Such trucks were first made so that the weight of the engine rested on slides on the truck frame, but recently they are nearly always suspended on links so that they can swing like a pendulum, as shown in figs. 190 and 191. The weight of the engine then rests on the center-plate, *H H*, which forms part of the plate, *B B*. This is suspended by links, *L L*, represented by dotted lines, which are attached by bolts to the cross-pieces, *m m*, which are fastened to the truck frame. In this way the truck wheels can move sideways independent of the engine itself. As the wheels and axles must move about the center-pin, *a*, fig. 221, the axle assumes a radial position to the curves of the track. It does this, too, quite independent of the driving-wheels, as is shown in fig. 221, which represents a plan of the wheels on a curve. It will be seen that the truck is not at all influenced by the position of the driving-wheels. This arrangement therefore gives great flexibility to the wheel base, and enables the wheels to adjust themselves to any lateral curvature or alignment of the track.

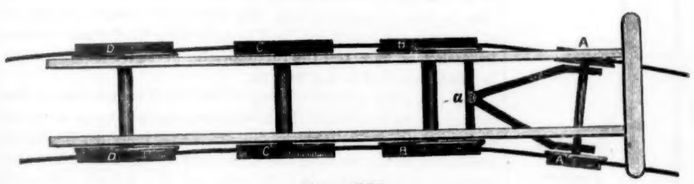

Fig. 221.

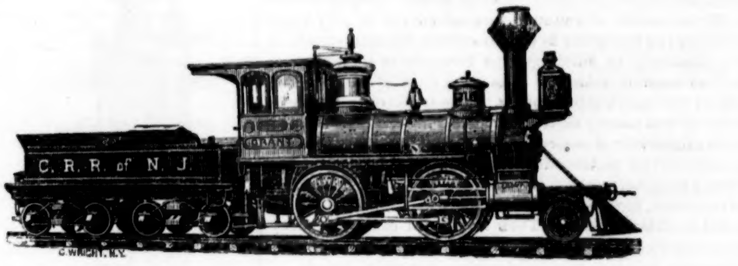

Fig. 222.

QUESTION 425. *For what purpose are locomotives like that shown in Plates 3 and 8 used?*

Answer. "Mogul" locomotives are often used for ordinary freight service, where heavy trains must be hauled, and also on steep grades. Consolidation locomotives represented in Plate

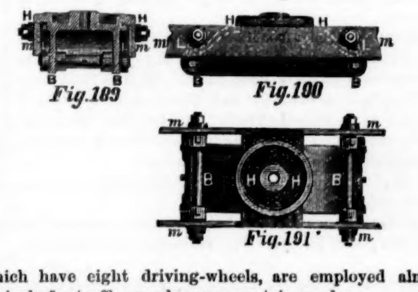

Fig. 189 Fig. 190 Fig. 191

8, which have eight driving-wheels, are employed almost exclusively for traffic over heavy mountain grades.

QUESTION 426. *What other kinds of locomotives are used for freight traffic?*

Answer. Various kinds of tank locomotives, that is, locomotives which have no separate tanks, but carry the water tanks and fuel on the frame and wheels of the locomotive itself, have been devised and are to some extent used. Plate 7 represents a locomotive of this kind on which the tanks are placed on each side of the boiler, and the fuel on a Bissell truck at the back end. A similar truck is placed at the front end, so that a locomotive of this kind can run equally well either way. The lateral movement of the two trucks also gives great flexibility to the wheel-base, so that such an engine will adjust itself easily to the curvature of the track. If, however, the two pairs of truck wheels should both stand on an elevated part of the track, and the driving-wheels on a depression, the latter would evidently not carry as much and the truck wheels would carry more of the weight of the engine than they did on a level part of the track. If the reverse condition of things should occur, that is if the driving-wheels should be on an elevation and one or both pairs of the truck wheels on a depression, then the latter would bear less weight than they did and the driving-wheels more. For this reason, in order to distribute the weight evenly on all the wheels, it is necessary to equalize the weight on the truck and driving-wheels, by connecting them with equalizing levers, similar to those which were described in answer to Question 293. These levers distribute any undue weight which may come on one wheel to that next to it. This is important, because if the driving-wheels bore less weight at some times than at others, their adhesion and their capacity to draw loads would be reduced in like proportion.

It is evident, however, that if the water tanks or fuel are carried on the driving-wheels there will be a greater weight on them when the tanks are full than when they are empty, and that therefore there will either be so much weight on the wheels at one time as to be injurious to the rails, or else there will be too little for adhesion at another. Of course cases are conceivable, and doubtless exist in practice where more adhesion is required to start a train and haul it during the first part of the "run" than will be needed during the latter part. In such cases doubtless the variable character of the weight might be an advantage instead of the reverse, but for ordinary practice a variable load on the driving-wheels would have the disadvantages which have been described. For this reason tank locomotives have been built like that represented in Plate 13. In this it will be seen that the weight of the water tank rests on a four-wheeled truck at the back end. A Bissell or two-wheeled truck is, however, placed in front in the same position as in the engine represented in Plate 7, and carries a portion of the weight of the boiler and machinery.

In order to get all the advantages which a four-wheeled switching engine possesses in having its *whole* weight on the driving wheels, and at the same time avoid the disadvantages which result from a short wheel-base and also from a varying amount of weight on the driving wheels, a locomotive like that represented in Plate 11 was designed by the writer with the whole weight of the boiler and machinery resting on the driving-wheels, and the water and fuel on a truck. By this means not only the objections to carrying the weight of the water on the driving-wheels is overcome, but at the same time the disadvantages arising from the short wheel-base of the switching locomotive, Plate 12, are also obviated. That is, all the *permanent weight* of the boiler and machinery of such a locomotive rests on the driving-wheels, and is therefore all *adhesive weight*, as it is in the switching engine, and at the same time by extending the frame beyond the fire-box and placing the water tank and fuel on this extension of the frame and supporting their weight on a truck, the engine has a wheel-base which is as long and as flexible as that of ordinary American engines like those represented in Plates 1, 2, 6, 9 and 10; and as the latter have only about *two-thirds* of their weight on the driving-wheels, locomotives of this design of the same weight as the others have fifty per cent. more adhesion, or they may be one-third lighter and have the same adhesion. As was explained in answer to Question 255, if an ordinary American locomotive runs backwards, that is with the driving-wheels in front, the friction of their flanges against the rails on curves of short radius will be very excessive. To avoid this with locomotives of the design last described, they are run with the truck first, which, being at the opposite end of the boiler from the position which it usually occupies, reverses the position of the boiler and other parts relatively to the motion of the engine. That is, the fire-box is then in front and the smoke-stack behind. Engines of this kind have been built and are now working and doing excellent service, but the prejudice which exists against running locomotives in the reverse direction to what has been customary seems to be the chief obstacle in the way of their use.

Another plan which possesses all the advantages of the locomotive described above and is free from the last objection is represented in Plate 15. This plan was first adopted by Mr. Robert Fairlie in England, but has been introduced into this country and very much improved by Mr. William Mason, of Taunton, Mass. In these locomotives, the driving-wheels and cylinders are attached to a truck frame which turns around a centre-pin like any ordinary truck. The steam and exhaust pipes are connected to the boiler and cylinder with pipes which have flexible joints. By this means the truck can move independently of the boiler, and thus the driving-wheels can adjust themselves to the curvature of the track, just as the wheels of any other truck do, and therefore the driving-wheels can be run first just as well as the truck wheels which carry the tank. This plan possesses the additional advantage that the fire-box can be made as wide and as long as may be desired without interfering with the driving-wheels. The flexible pipes are, however, usually considered an objection; but with the improvements which have been made in their design and construction, the difficulties which were at first encountered have probably been overcome. At any rate if there is no other objection to the use of such locomotives, ingenuity and care should in time overcome that one. Plate 5 represents a locomotive of this plan, with six driving-wheels and a six-wheeled

carrying truck under the tank. This latter plan of locomotive is intended for heavy freight traffic.

QUESTION 427. *What kind of locomotives are used for passenger trains?*

Answer. Eight-wheeled American locomotives are used almost exclusively for passenger service. Usually the driving-wheels of such locomotives are larger in diameter than are used for freight traffic. Their size varies from 5 feet to 5 ft. 9 in. in diameter. The locomotive by the Mason Machine Works represented in Plate 9 has 5¾ feet driving-wheels. For very heavy express trains locomotives with 17×24 inch cylinders and weighing 34 tons are now used on many through lines.

QUESTION 428. *What is meant by suburban and metropolitan railroads, what is the nature of their traffic, and what kinds of locomotives are needed for it?*

Answer. The traffic of suburban railroads consists chiefly of the transportation of passengers who do business in the city to the latter in the morning and to their homes in the evening. As the largest number of passengers must be carried during a few hours in the morning and evening, it is necessary to run very heavy trains at those times. As the passengers must be distributed at many stations which are near together, it is necessary to stop often; and in order that the average speed may be reasonably fast the trains must run very rapidly between these stations. It is therefore necessary to have heavy locomotives, with more than the usual proportion of adhesive weight, so that the trains can be started quickly without slipping the wheels. The main valves should also have a liberal amount of travel, so that steam will be admitted to and exhausted from the cylinders quickly. In some cases it is thought desirable to have locomotives which will run equally well either way, so that it will not be necessary to turn them around at each end of the "run."

By metropolitan railroads are meant railroads in large cities. They may be divided into two classes, one for carrying freight cars from the outskirts of cities to the warehouses and stores at their business centres, and also from the terminus of one road to that of another. Metropolitan railroads of this kind are usually branches of lines which extend from the city. Locomotives for such traffic must have great tractive power, in order to pull heavy trains, and as the speed is usually slow the wheels and the boiler capacity may be small. They must also usually be capable of running through curves of very short radius; and as the traffic is usually carried through streets in close proximity to buildings, the locomotives should be as nearly as possible noiseless. The other class of metropolitan roads is for carrying passengers. The traffic of the latter is similar to that usually carried on horse railroads, and consists almost exclusively of passengers. At present (1874) there are only one or two metropolitan railroads in this country for carrying passengers which are operated by steam power. It seems certain, however, that their use will soon become very general in all large cities. Their traffic will consist of many light trains run at short intervals and at comparatively slow speeds, and therefore very light locomotives are required.

QUESTION 429. *What kinds of locomotives are used for suburban railroads?*

Answer. The ordinary American eight-wheeled locomotives are used more than any other kind; but a number of locomotives like that represented by fig. 222 have been built and are used for this traffic. These have one pair of driving-wheels in front of the main pair and a Bissell truck in front of the cylinder. With this arrangement the driving-wheels bear a larger proportion of weight than they do if arranged in the ordinary American plan with a four-wheeled truck. Another plan is that shown in Plate 13. Such engines, as will be seen, have a Bissell truck at each end, and therefore they run equally well either way. In some cases the tanks of such engines are carried on the top and sides of the boiler. When they are obliged to run only a short distance, and a small supply of water is needed, this arrangement answers very well; but it is impossible to carry a large supply of water in this way without overloading the wheels of the locomotive, and at the same time increasing the evils of a varying load on the driving-wheels.

Locomotives like that shown in Plate 14 are also used for suburban traffic. As shown in the engraving they have a four-wheeled truck at one end and one with two wheels at the other, so that it is thought that they can be run safely either way. The four-wheeled truck carries the weight of the water and fuel.

The plan of engine represented by Plate 11 would be very well adapted for this kind of traffic. Excepting on curves with a very short radius, it could be run in either direction at any required speed, without encountering any other difficulty excepting the prejudices of those who run it.

As double-truck locomotives similar to that shown in Plate 15 can adjust themselves to any curve, this objection could not be urged against their use.

QUESTION 430. *What kind of locomotives are used on metropolitan railroads?*

Answer. For freight traffic ordinary switching locomotives like that represented in Plate 12 are often employed. In some cases these have the tanks on the locomotives. It often happens, though, that such traffic must be conducted in the streets of a city, and that the noise, especially of the exhausting steam, is thus liable to frighten horses and disturb the occupants. It is, then, necessary either to exhaust the steam or render its escape noiseless, which is done by exhausting it into the water tanks. Street locomotives which have a condenser similar to the surface condensers used on marine engines are used on the Hudson River Railroad in New York. The exhaust steam passes through these and then escapes into the tanks. The latter are long and narrow, so as to expose a great deal of surface to radiation, and in this way cool the water which becomes heated by the steam. The engines have four driving-wheels and vertical boilers. The cylinders are connected to a crank shaft with a pinion on it, which gears with another wheel of larger size on the driving axle. In this way the speed is reduced and great tractive power can be exerted. The whole of the engine is inclosed so as to hide the machinery, the sight of which is supposed to frighten horses. The engines were designed and patented by Mr. A. F. Smith, formerly Master Mechanic of that road.

For roads carrying passengers almost exclusively, an entirely different class of locomotives is needed. To suit passengers it is of course necessary to run a great many trains at very short intervals. When this is done the trains are necessarily very light, and therefore only light locomotives are needed. Plate 17 represents the locomotives employed on the Greenwich-street Elevated Railroad in New York. These engines weigh only 8,000 lbs., and the wheels are 30 in. diameter and the cylinders 7 × 10 in. The peculiarity in their construction consists in their having an intermediate shaft between the two pairs of driving-wheels. This shaft has two cranks inside of the frames and two outside. The cylinders are connected to the inside cranks, and the coupling-rods to those on the outside. The water is carried in a tank on top of the boiler. The fuel is anthracite coal. Plate 16 represents a locomotive designed by the writer on the same system as that represented in Plate 11, excepting that it has a vertical boiler instead of one of the ordinary locomotive type. The engine was intended for light suburban or metropolitan traffic. Thus far it has existed in design only.

PART XXII.

CONTINUOUS TRAIN BRAKES.

QUESTION 431. *What are meant by automatic or continuous train brakes?*

Answer. Continuous train brakes are brakes which can be applied to all the cars of a train by the locomotive runner on the locomotive. In some cases such brakes are arranged in such a way that they can also be applied from any car in the train, or are made self-acting in case of an accident, such as a car getting off the track or a train breaking in two.

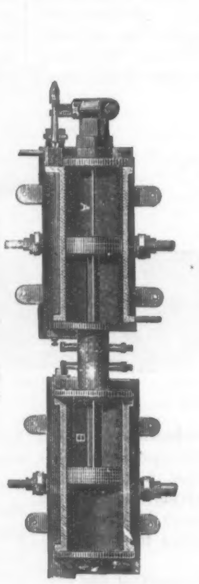

Fig. 223.

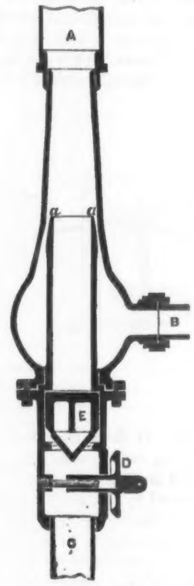

Fig. 224.

QUESTION 432. *What are the principal systems of brakes of this kind in use?*

Answer. What is called, after its inventor, the Westinghouse atmospheric brake is now used more than any other. Next to this Smith's vacuum brake is used most. Besides these two, Creamer's, Ward's, Loughridge's and Henderson's systems of brakes are used to a limited extent. The two first are, however, the only ones which have come into sufficiently extensive use as yet to justify us in describing them here.

QUESTION 433. *How does the Westinghouse brake act and how is it constructed?*

Answer. As its name indicates, the medium employed for transmitting the power for operating the brakes is atmospheric air.

This is compressed to any required density by a steam pump which is located between the driving-wheels, or in any other convenient position on the locomotive. This pump is shown in section in fig. 223 and consists of two cylinders, the upper one, *A*, the steam cylinder, the piston of which is connected by its rod with the piston in the lower cylinder *B*. This latter is operated by the steam piston, and at each stroke a quantity of air equal to the space swept through by the lower piston is compressed and thus forced into a cylindrical reservoir, which is usually placed under the foot-board of the locomotive in which it is stored for use at any time when the brakes are to be applied. The air and steam cylinders are supplied with suitable valves for admitting and releasing the air and steam. From this reservoir it is conducted back under the tender and cars by pipes, which are connected together between the engine and tender and between the cars by India-rubber hose. Two pieces of hose are attached to the engine and also to each end of the tender and cars, so that in case one piece should break the others will act. Each of these pieces is united or coupled to the corresponding piece opposite to it by a peculiar coupling made for the purpose, so that they can be quickly disconnected if the cars, engine or tender are uncoupled.

Under the tender and also under each car is a cylinder and piston. The compressed air is conducted to this cylinder in front of the piston when the brakes are to be applied. As the piston-rod is connected by a bell crank to the brake levers when the piston is forced out by the pressure of the air, the brakes are at once applied to the wheels. As the reservoir under the foot-board is connected by the pipes which have been described with the cylinders under each car and the tender by simply opening communication between the reservoir and the pipes, the air at once rushes from the reservoir back through the whole length of the train, and so rapid is its motion and quick its action that only a second or two intervenes between the opening of communication and the application of the brakes. To relieve or "let off" the brakes it is only necessary to close the reservoir cock and open communication from the air pipes to the external atmosphere, when the compressed air in the brake cylinders will escape, and the springs ordinarily used on car brakes will cause the pistons to resume their former positions.

For the purpose of opening the connection from the reservoir to the brake cylinder, and closing this connection and opening one from the latter to the external air, a single three-way cock is commonly used. This is arranged at such a point as to be under the control of the engineer, so that he can at pleasure turn on the compressed air with any degree of force, instantaneously or slowly or with a varying power, or by another turn of the cock let it off as freely, still keeping it under the same complete control.

QUESTION 434. *How does the vacuum brake act and how is it constructed?*

Answer. The power is applied to the brakes of the cars in this system by exhausting instead of compressing the air. This is done by means of an ejector, of which fig. 224 is a section. This operates somewhat like an injector. Steam is admitted into the pipe B, and escapes through the annular or circular opening, *a a*. The effect of this is to create what is called an "induced current," or to draw the air from the pipe *C*, which, with the steam, escapes at *A*. This produces a partial vacuum in the pipe *C*, which extends back under the cars. The pipes under the cars are connected together by rubber hose, which are prevented from collapsing by coils of wire inside. Under the tender and under each car are india-rubber cylinders with cast-iron ends, one fastened to the car and the other movable. The rubber cylinders can be extended or compressed somewhat like the bellows of an accordeon. They are supported by iron rings inside, placed from 4 to 6 inches apart, so as to prevent them from collapsing when the air is exhausted from them. When this is done the pressure on the movable cast-iron end draws it towards the other one, and by attaching the former to the brake levers by a rod the force of the pressure on the head is communicated to the brakes.

The ejector is placed on top of the boiler, and when the brakes are to be applied the locomotive runner opens a valve, which admits steam into the ejector, which instantly begins to produce a partial vacuum and thus apply the brakes. When the pressure of the brakes is to be released the release valve, *D*, is opened, which admits air into the pipe *C*, through which it is conducted back to each of the india-rubber cylinders and thus counteracts the pressure on the ends and releases the brakes.

Both the atmospheric and the vacuum brakes have recently been applied to the driving-wheels of locomotives with very excellent results.

ANNUAL REPORTS.

Cincinnati, Hamilton & Dayton.

This company operates the following lines, the first named being owned, the others leased:

	Miles.
Cincinnati, Hamilton & Dayton, Cincinnati, O., to Dayton..........	60
Dayton & Michigan, Dayton, O., to Toledo..........	142
Cincinnati, Richmond & Chicago, Hamilton, O., to Richmond, Ind.,	45
Total..........	247

The company also controls the Cincinnati, Hamilton & Indianapolis (formerly the Junction) Railroad, from Hamilton, O., to Indianapolis, Ind., 98 miles. Two extra rails are laid over the main line from Cincinnati to Dayton, over which the 6 feet gauge trains of the Atlantic & Great Western road run.

The operations of the main and leased lines for the year ending March 31, 1874, were as follows:

	C., H. & D.	D. & M.	C., R. & C.	Total.
Passengers........	$299,412.33	$332,476.51	$72,932,30	$704,821.14
Freight..........	574,847.03	760,196.70	130,070.28	1,405.114.01
Rents..........	190,600.00	....	......	3,190,600.00
Other sources.....	107.138.90	66,284.57	10,173.74	183,597.21
Total earnings..	$1,171,998.26	$1,098,957.78	$213,176.32	$2,484,132.36
Working expenses.	712,795.10	683,952.74	151,292.59	1,550,040.43
Net earnings....	$459,203.16	$413,005.04	$61,883.73	$934,091.93
Taxes..........	56,439.70	36,615.74	2,827.22	95.882.66
Interest..........	154,430.00	196,552.85	44,237.50	395,220.35
Dividends..........	......	136,537.76	....	136,537.77
	$210,869.70	$369.706.35	$47,064.72	$627,640.77
Net result.....	$248,333.46	$43,298.69	$14,819.01	$306,451.16
Gross earnings per mile........	$19,533	$7,739	$4,737	$10,057
Net earnings per mile......	7,653	2,908	1,375	3,782
Per cent. of expenses..........	60.81	62.42	70.97	62.40

Comparing the total result with the preceding year, there is an increase of $15,064.75, or 0.61 per cent., in gross earnings; a decrease of $40,223.80, or 2.53 per cent., in expenses; and an increase of $55,288.55, or 6.29 per cent., in net earnings.

On the main line revenue trains ran 651,829 miles carrying 652,098 passengers and 616,830 tons of freight. The average earnings per train mile were $1.79, the average expenses, $1.09, making the net earnings per train mile $0.70.

Improvements during the year include a new freight house and 3,682 feet of new siding at Brighton; 8,500 feet of new siding at Hamilton, of which 1,870 feet is of both gauges. On the Cincinnati, Hamilton & Dayton 1,542 tons re-rolled iron, 190 tons steel and 20,660 new ties were used in renewals. On the Dayton & Michigan 1,272 tons iron and 54,448 new ties were used; on the Cincinnati, Richmond & Chicago, 100 tons of iron and 16,484 new ties.

Improvements on the Cincinnati, Hamilton & Indianapolis include 13,014 feet new side-track; 874 tons new rails and 79,132 new ties; 56 miles of track graveled and surfaced; two new bridges, one 686 feet, one 135 feet long; a large amount of trestle renewed; 100 box, 29 flat and 6 caboose cars built in

the Lima shops. This road still requires a large expenditure to put it in good condition.

The account with the Cincinnati, Hamilton & Indianapolis stands as follows, the account covering 16 months, from December 1, 1872, to March 31, 1874:

Purchase of road	$1,857,320 60
New equipment	217,883 19
Real estate and construction	80,523 05
Renewals	330,492 63
Interest and discount	215,869 49
Operating expenses	557,885 90
	$3,259.974 86
Bonds issued	$1,846,000 00
Earnings of road	547,032 18
Advances made by C., H. & D. Company	866,942 68
	$3,259,974 86

The net earnings for the year with the other receipts, and the disposal made thereof, were as follows:

Net earnings	$306,451 16
Sale of third mortgage bonds	118,000 00
Sale of wood land, stocks and bonds	21,857 14
Bills payable increased	191,098 77
Decrease in material on hand	49,884 35
	$687,291 42
Advances to C., H. & Indianapolis	440,617 53
" " Dayton & Michigan, new construction	50,034 60
Real Estate	24,006 00
Current liabilities reduced	167,775 73
Bills receivable increased	654 81
D. McLaren, trustee	4,202 75
	$687,291 42

The property owned is represented by the following securities:

Stock ($58,333 per mile)	$3,500,000
Funded debt ($35,833 per mile)	2,150,000
Total ($94,167 per mile)	$5,650,000

The funded debt has been increased by $118,000 during the year.

The Dayton & Michigan property is represented by $3,679,199 ($25,910 per mile) of stock, and $2,787,900 ($19,633 per mile) of funded debt. The capital account of the Cincinnati, Richmond & Chicago includes ($382,600 ($8,502 per mile) of stock, and $625,000 ($13,888 per mile) of bonds.

Georgia.

This company owns the following lines:

	Miles.
Main line, Augusta, Ga. to Atlanta	171
Athens Branch, Union Point to Athens	39
Washington Branch, Barnett to Washington	18
Total	228

It also operates under lease the Macon & Augusta road, from Camak, Ga., to Macon, 78 miles, three miles of which, from Camak to Warrenton, it owns. The accounts of this road, however, are stated separately.

The property is represented by the following securities:

Capital stock ($18,182 per mile	$4,200,000
Bonds ($2,632 per mile)	608,000
Total....($20,814 per mile.)	$4,808,000

There is an investment of $879,891.67 in stocks and $138,060 in the bonds of various railroad and steamship companies.

The earnings and expenses for the year ending March 31 were as follows:

	1874.	1873.
Passengers	$307,047 23	$375,339 26
Freight	1,239,336 69	1,222,788 63
Mails	25,401 10	25,328 64
Total earnings	$1,571,785 02	$1,623,456 53
Conducting transportation	265,445 59	253,115 54
Motive power	349.439 55	327,066 61
Maintenance of way	212,044 76	316,999 43
Maintenance of cars	60,521 09	79,649 34
Extraordinary expenses	157,755 74	156,429 84
Total expenses	$1,045,206 73	$1,133,260 75
Net earnings	$526,578 29	$490,195 78
Gross earnings per mile	$6,894	$7,120
Net " " "	2,309	2,150
Percentage of expenses	66.50	69.81

This shows a decrease of $51,671.51, or 3.18 per cent. in gross earnings; a decrease of $88,054.02, or 7.77 per cent. in expenses; and an increase of $36,382.51, or 7.42 per cent. in net earnings. The extraordinary expenses were mainly for new equipment.

The following is a partial comparison of the business of the two years:

	1874.	1873.
Train mileage	1,140,055	1,103,551
Bales cotton carried	273,293	294.300
Bushels grain	1,107,382	1,897,640
Barrels flour	123,209	96,181

The through freight business has been affected by the opening of the Atlanta & Richmond Air Line. Not much benefit can be derived from the Port Royal connection until regular facilities for ocean transportation from that port can be secured.

During the year 12¼ miles of new iron has been used in renewals, and a number of the smaller buildings have been renewed or rebuilt. For the current year 40 miles of new iron is needed on the main line and eight on the branches.

Five new locomotives were purchased, and four old ones condemned and broken up. There have been built during the year at the company's shops 1 pay-car, 1 baggage and 85 box cars, besides 18 box and 18 flat cars rebuilt. The equipment at the close of the year consisted of 52 locomotives; 27 passenger and baggage, mail and express cars; 506 box, 35 stock, 28 coal, 129 flat and 21 caboose cars; 1 pay, 24 shanty and 2 wood cars; a total of 45 passenger train, 719 freight train and 27 service cars.

OLD AND NEW ROADS.

South Side, of Long Island.

On application of the trustees for the bondholders, the United States District Court ordered the postponement of the bankruptcy sale from August 22 to August 31, the same day on which the foreclosure sale is to take place.

Mexican Railway.

At a special meeting in London on the 5th of August, called for the purpose of authorizing the directors to issue £1,200,000 in new preferred shares. The Chairman represented that when the road was incomplete, and the company in difficulty, sums of money amounting to £2,485,400 were advanced from four houses, that the ordinary shareholders had advanced £850,000, and the Mexican government £750,000. Considerable indignation was shown because no allusion was made to these claims in the June report, when a prospect of an early dividend was held forth, whereas it seemed that there were these liabilities of £4,000,000 between the shareholders and a dividend. A shareholder moved an amendment that the meeting accepts a proposition to settle with the creditors for a lump sum of £3,800,000, provided it be paid by 8 per cent. bonds for about £1,936,000, and by common stock for the balance. This motion was carried by a vote of the meeting, but the Chairman demanded a poll, which was to be had on the 11th.

Philadelphia & Reading.

This company has ordered a general suspension of work at all the coal mines which it owns or controls, and has cut off the usual supply of cars from the private operators on its lines. Four or five mines continue running to supply the road and certain iron furnaces. It is thought that the suspension will continue for several weeks. It is intended to check the production and give the combined coal companies a chance to work off the large stock now on hand.

Lake Shore & Michigan Southern.

The following figures, showing the average mileage of the freight cars of this road for the year ending June 30, 1874, are furnished by the car accountant, George H. Weeks:

Box Cars—The general average for box cars for the year was 15,695 miles each car and an average of 43 miles per day, Car D 1698 making the highest run for one month, which was 3,067 miles for December. The highest run for a year was Car D 1552, which made 20,635 miles, or 56½ miles per day.

Stock Cars—The general average for stock cars for the year was 32,180 miles each car and an average of 88 miles per day, Car D 5574 making the highest run for one month, which was 5,560 miles for May. The highest run for a year was Car D 5831, which made 40,773 miles.

Platform Cars—The general average for platform cars for the year was 7,685 miles each car and an average of 21 miles per day, Car D 11349 making the highest run for one month, which was 1,482 miles for January. The highest run for a year was Car D 11439, which made 10,841 miles.

Coal Cars—The general average for coal cars for the year was 7,807 miles each car and an average of 21 miles per day, Car D 13460 making the highest run for one month, which was 1,553 miles for September. The highest run for a year was Car D 13260, which made 9,512 miles.

Longwood Valley.

It is stated that work on the grading of this road has been resumed with the intention of completing it in about a year, and of leasing it when built to the Lehigh Valley Company, to be worked as a branch of the Easton & Amboy. The road is to extend from the New Jersey Midland at Newfoundland, N. J., southwest to the Easton & Amboy, near Clinton, a distance of about 35 miles, running through the iron region nearly the whole distance.

Galena & Southern Wisconsin.

It is expected that tracklaying will begin about September 1, and that 30 miles, from Galena, Ill., to Platteville, Wis., will be finished this Fall. Two engines and 25 cars are contracted for.

Peoria, Atlanta & Decatur.

The Peoria (Ill.) *Transcript*, of August 22, says: "Tracklaying was commenced upon the opposite side of the 12-mile gap on the Peoria, Atlanta & Decatur Railway Tuesday morning. The tracklayers will work toward this city, and reach the Mackinaw River by the time the bridge is completed at that point. President Hitchcock writes to this city that he will have trains running regularly between this city and Kinney, a station on the Springfield & Clinton road, seven miles beyond Atlanta, during fair week."

Ashuelot.

The Supreme Court of New Hampshire has decided that the reorganization of this company in 1872 was legal and valid and that the company has a right to redeem its road by paying the balance due on the bonds. The court also appointed a master to take account of the money received by John H. Elliott, trustee, and also of the rents paid and due by the Cheshire Railroad Company which has been operating the road since 1861 under a lease from the trustee. The master is also to ascertain the amount still due on the bonds.

The road is 24 miles long, from Keene, N. H., southwest to South Vernon, Mass.

St. Paul & Pacific.

A telegram from St. Paul, Minn., says that a suit has been begun in the Hennepin County Court against the St. Paul & Pacific Company, First Division, by Horace Thompson and S. J. Tilden, trustees, to foreclose a mortgage of $6,000,000. Another suit to foreclose another mortgage of $2,800,000 has been begun by H. Thompson and T. M. Davis, trustees.

Missouri, Iowa & Nebraska.

The Missouri Circuit Court has decided that this company is subject to the law of 1869, and has granted an injunction to restrain the Scotland County Court from issuing $200,000 county bonds in aid of the road, no popular vote having been taken on the issue.

Roanoke Valley.

Deputations from Mecklenburg County, Va., have been visiting Richmond to see if something cannot be done to secure the completion of this road from Clarksville to Keysville. The Richmond & Danville Company was building the road, but was obliged to suspend work on it last Fall, and nothing has been done this season.

Victoria.

This road is intended to connect Toronto with the main line of the Canada Pacific on the Upper Ottawa. Arrangements have been made to build a section of about 30 miles from the Toronto & Nipissing road near Uxbridge, Ont., northeast to Lindsay, with a branch some 10 miles long to Port Perry.

Wellington, Grey & Bruce.

Efforts are being made to induce this company to complete and open the South Extension, which was to have been in operation last Fall. There is some talk of legal proceedings against the company which received liberal municipal bonuses, besides a large grant from the Ontario Government. Mills have been built along the line and large quantities of lumber got out in the expectation of being able to ship it this season.

Martha's Vineyard.

The rails are all laid on this road, which is of three-feet gauge and extends across the island of Martha's Vineyard from Oak Bluffs south by east to Katama. It is 8½ miles long and is intended mainly for pleasure travel, the island being a well-known summer resort. It is entirely isolated, its only connection with the mainland being by steamboat.

Southern Freight Rates.

Some time since a meeting of representatives of the leading Southern lines was held in Augusta, Ga., at which an agreement was made that no more cutting of rates should be allowed, and that any agent doing so should be discharged. Any charge of cutting was to be referred to a board of inquiry composed of commissioners appointed by the parties to the agreement, each party naming one. Another convention was held in Columbia, S. C., August 5, when the action of the Augusta meeting was ratified.

A third convention was held in Boston, August 25, at which the various rail and steamer lines from New York and Boston southward were represented, and a tariff was agreed upon for freight from Boston or New York to all principal Southern points. The new rates from those cities for the six classes to Atlanta are: $1.30, $1.20, $1.00, $0.85, $0.70, $0.60 per hundred pounds; to Mobile or New Orleans, $1.15, $1.10, $1.05, $0.85 $0.70, $0.70; and to other points in proportion.

New Orleans, Mobile & Texas.

Some time since the road west of the Mississippi was sold under foreclosure of the first mortgage and bought in by Frank Ames as trustee for the bondholders. Subsequently the Louisiana District Court ordered the road to be sold September 30, to satisfy the second mortgage for $800,000 made to the State of Louisiana, and the road and property were seized by the sheriffs of the various parishes through which it runs. Since then, however, on application of Ames, the United States Circuit Court has issued an injunction prohibiting this sale and ordering the United States Marshal to put Ames once more in possession of the road. The Marshal accordingly took possession of the property August 18, no opposition being made by the sheriffs.

Canada Southern.

A short time since the Canadian Court of Chancery gave this company the right of approach to the Niagara Suspension Bridge across the tracks of the Great Western road. August 20 the Chief Engineer with a party of laborers commenced to lay the necessary track, tearing up for that purpose a small portion of the Great Western track. The latter company, however, sent down a superior force of men, drove off the Canada Southern men and ran an engine off the track at the place where the frogs were to be put down. The Canada Southern at once procured an injunction and orders of arrest.

The Great Western claims to have leased the Suspension Bridge for 99 years at a rental of $45,000 per annum, and demands of the Canada Southern an equivalent for its use, which is refused on the ground that the Courts have decided that the bridge is a public highway.

The latest advices state that the trouble has been settled by a satisfactory compromise, and the Canada Southern trains will soon cross the bridge.

Hoosac Tunnel Line.

The State of Massachusetts invites proposals for the excavation of rock and building of arch (mainly of brick) required in certain lengths of the Hoosac Tunnel in addition to the work now being done by Shanly & Co. The distances to be protected by arching make up an aggregate length of about two-fifths of a mile (2,112 feet), and may be increased as occasion may require.

Separate proposals are also asked for building the granite facade at the east end of the tunnel, and for building one wrought iron bridge.

Specifications and other information can be obtained from Benj. D. Frost, State Engineer, North Adams, Mass. Proposals will be received until September 10, and must be addressed to Alfred Macy, Chairman Tunnel Committee of Executive Council, State House, Boston, Mass.

Northern Pacific.

Recently Elijah Meyers, a bondholder, brought suit against this company in the New York Supreme Court for the payment of a 7.30 bond. He asked that the company be enjoined from issuing any more such bonds; that the trustees under the mortgage, Jay Cooke and Wm. B. Ogden, be compelled to enter on the grant lands and sell them for the benefit of the bondholders, and that the trustees be removed. On application of the defendants the suit was subsequently removed to the United States Court.

New York, Providence & Boston.

This company has bought a large tract of waterside property in Stonington, Conn., and will make a large addition to its yard and dock accommodations there. The line of the road is also to be changed so that trains will not pass through the village.

Chicago & Southwestern.

It is said that the Chicago, Rock Island & Pacific Company, the lessees, have offered to build a branch from Plattsburg, Mo., south to Kansas City, about 30 miles, provided Kansas City will give $100,000, and the other towns interested $50,000. Nearly all the road can be built upon an old grade, that of the Parkville & Grand River road, which can, it is said, be put in good condition with very little labor.

New York Central & Hudson River.

The attempt to fill up the sink-hole on the Athens Branch near Coxsackie has been abandoned, after dumping into it an enormous quantity of earth and gravel. The gravel having all disappeared, the road is no nearer level than before, and now a new track is to be built around the hole.

Dividends.

The Chicago, Burlington & Quincy Railroad Company has declared a semi-annual dividend of 5 per cent., payable September 15.

Meetings.

A special meeting of the land-grant bondholders of the old Des Moines Valley Railroad, the section which is now the Des Moines & Fort Dodge, will be held at No. 61 Wall street, New York, September 1.

The annual meeting of the Toledo, Wabash & Western Railway Company will be held in Toledo, O., October 7. Transfer books will be closed from September 5 to October 8.

Erie.

The organization of the executive departments adopted by the late administration has been almost entirely done away with and a return made to the old system of giving the appointment of all subordinates to the division superintendents and making the latter directly responsible.

St. Louis & Southeastern.

According to the *Frankfurter Zeitung*, General Winslow, the President of this company, who is now in Europe, proposes to the holders of the first-mortgage bonds that they accept new bonds in payment of the coupons due in 1874, 2 per cent. in cash and 5 per cent. in bonds for those due in 1875, 3 per cent. in cash and 4 per cent. in bonds for the next year, and so on, each year one dollar more in cash and one less in bonds for each seven dollars due, which would make the company resume cash payments in full in 1880, when its debt would be increased by 22 per cent. through this funding of the coupons, equivalent to a little more than three years' interest. About $1,600,000 of the bonds are held in Holland, $1,000,000 in Germany, and $500,000 in the United States.

Mattoon & Grayville.

The directors of this company have procured an injunction restraining the Chicago & Illinois Southern Company from interfering with or attempting to control the road. They have also let a contract for the construction of the road to George Tenney, who is to begin work at once. An attempt is to be made to get some sort of guarantee for the bonds or assistance of some kind from the Ohio & Mississippi. The line of the road is from Mattoon, Ill., south by east some 90 miles to Grayville on the Wabash, 40 miles below Vincennes.

Delaware & Hudson.

This company is reported to have closed a contract recently for 5,000 tons of steel rails, 3,000 from the Cambria Iron Company of Johnstown, Pa., and 2,000 from the Rensselaer Works at Troy, N. Y., at a price equivalent to less than $90 per ton at tide-water. A year and a half ago iron rails cost nearly as much as this.

Continued on page 336.

RAILROAD GAZETTE

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S. WRIGHT DUNNING AND M. N. FORNEY.

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Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

WARMING CARS.

This much discussed subject presents itself again for consideration with the approach of cold weather. Although it may be a very much worn topic, it is nevertheless an important one, and, we regret to say, one about which there is thus far very little agreement in the minds of those who supply the means of controlling the temperature and the purity of the air we breathe when we travel by rail. There is danger that if we once enter into the mazes and apparent mysteries of what is called the science of ventilation, our readers may grow weary of investigating the atomic composition and specific gravity of the atmosphere long before we or they make a practical solution of the question. We will therefore confine ourselves to considerations about which there can be no question, and attempt to indicate to car-builders how to warm their cars so as to be comfortable to those who must occupy them.

The first and doubtless the most important consideration is warmth. It is said by woolen manufacturers that it is impossible to wash wool, that is spin and weave it, in a cold atmosphere, and it is therefore necessary to have mills where it is manufactured kept at a temperature of about 70 degrees. Now the same thing is true of the human body. The delicate processes which take place in its complicated organism require warmth and will be either partly or entirely arrested without it, and it is beginning now to be recognized as it never has before that one of the most prolific causes of ill health is the want of sufficient protection from cold, the result either of insufficient clothing or uncomfortable lodging. One of the most dangerous things for a delicate constitution is to be in a cold place without exercise and thus become thoroughly chilled through. To guard against this danger, all mankind have the common sensation of discomfort which is produced by cold, and all animals seek warmth in cold weather,. It is important, therefore, first of all, that cars be comfortably warmed, to a uniform temperature of from 65 to 70 degrees. Any method of warming which fails to do this, no matter how ingeniously constructed, does not fulfill the first and most important purpose for which it is constructed. It is therefore important above all things that the stoves should be so constructed that a fire can be made to burn in them without difficulty. It is hardly necessary to say to those who have traveled much that this first and primary consideration is very far from being fulfilled in some of the stoves which are to be found in railroad cars. Some of them are so ingeniously made that unless the person understands the art of combustion thoroughly it is impossible to make a fire burn in them. A simple old-fashioned rectangular stove for wood, and a vertical cylindrical or pear-shaped one for coal, are undoubtedly the simplest and cheapest forms for ordinary use, and have the advantage that every person understands them. With such stoves, however, it is found that while a car can be thoroughly warmed the temperature at the top or roof will often be as much as and probably often more than 40 degrees hotter than at the floor. This of course reverses the hygienic maxim of keeping your head cool and your feet warm. The question then is, how can the temperature be equalized? Three methods have been adopted for doing this: first, that of warming the car by hot water or steam-pipes at the floor of the car; second by warming the air and conducting it from the stove through the car and delivering it at or near the floor, and, third, by exhausting air from the floor. Unboubted the first method produces the most agreeable warmth, the second furnishes the largest supply of fresh air, but the third is the simplest, cheapest and lightest. The weight and expense of the different methods are in the order in which they are named, the first being the heaviest and most expensive. Either of the three will give good results in equalizing the temperature of the air, but their efficiency in this respect, however, is as things usually are, about in proportion to their expense.

In heating cars there is, however, the question of ventilation, which presents some difficulties. We will not discuss here the importance and necessity of furnishing an adequate supply of fresh air; we will assume that it is proved, and people generally believe that it is important and necessary (which we fear alas many do not); then, the next question to consider will be, *how* is the requisite quantity of air to be supplied. In other words, and these are so important that we capitalize them, HOW IS THE SUPPLY OF FRESH AIR TO BE ADMITTED INTO THE CAR? Before considering this it will be well to remember that a supply of fresh air is by mankind almost universally regarded as subordinate to warmth. That is, if a car full of passengers must choose between breathing foul air and being warm, or inhaling fresh air and feeling cold, ninety-nine in a hundred, or perhaps a larger proportion, will prefer the former; and rightly so, because there is usually no immediate great danger in breathing impure air for a few hours, and there is always great risk in being thoroughly "chilled through." Therefore it is absolutely necessary to admit the air in such a way that it will not be a source of discomfort to those who occupy the car.

There are also three ways of doing this: first, that of subdividing the current of air which enters the car into many very small streams and distributing them through the whole car. This can be used very effectively with the hot-water or steam-pipe system of heating; but with ordinary stoves the cold air is liable to get to the floor and remain there, whereas with hot-water pipes at the floor it soon becomes warmed: second, by warming the fresh air before it enters the car; and third, by admitting air at the end of the car, immediately in front of and over the stove, so that as it enters it becomes mixed with the hot air which rises from the hot stove, and thus is not a cause of discomfort to passengers. As our readers know, we have frequently called attention to the fact that a car can be very thoroughly ventilated by simply opening the window in front of the stove and closing the inside blind. The air then enters, and by the inclination of the slats in the blind it is directed upward, so that it is not felt at all by those who sit immediately behind the stove. Now, after studying the subject of car-ventilation with considerable care for a number of years, we have concluded that for ordinary use in cars where there are no special attendants, as there are in drawing-room and sleeping cars, ventilators which act on the same principle as these end windows are the most effective device for ventilating cars which has thus far been used. The difficulty is in keeping them open. To remedy this and at the same time ventilate cars well in cold weather, we believe the most effective means which has been used is simply to cut openings from 12 to 15 inches wide and 8 to 10 inches high above the end windows, next the stoves, and then put in wide slats so inclined as to direct the entering current of air upwards into these two openings, without providing any means for closing them. This would insure their being open all the time and the slats would to a very great extent exclude cinders, snow and rain. This arrangement with any form of stove in which a fire will burn without difficulty will give very good results. Undoubtedly the temperature of the car will be equalized if in addition to the end ventilators described a ventilating flue with an opening near the floor is provided at each end of the car and on the side opposite to the stove. But such flues, unless provision is made to prevent it, are very apt to act in the reverse way from what they were intended to, and to have downward instead of upward currents in them. This can be guarded against by attaching a movable hood to the top, arranged with a vane so that it will always turn with its mouth in the direction opposite to that from which the wind is blowing, and thus be sure always to exhaust the air from the flue when the car is running. By covering the mouth of the flue at the bottom of the car with some kind of grating similar to that used in ordinary house registers, and suspending over it an apron of rubber cloth, leather or canvas, so that it will act like a valve, allowing the air to enter and ascend the flue, but preventing any from entering the car by that channel, there would, we believe, be no difficulty from reversed currents descending the flue and thus admitting instead of exhausting cold air from the floor. Even with a vane at the top this might occur when the car is standing still, but would be prevented by a valve similar to that described.

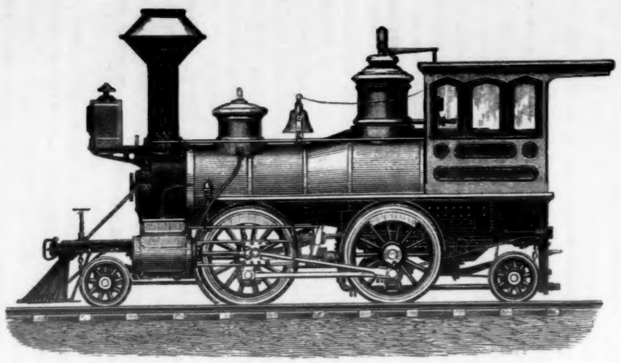
The end ventilators can of course be used with any heating apparatus which is employed, but when the car is warmed by currents of warmed air the ventilators described are not so necessary as they are when ordinary stoves or hot-water pipes are employed. No method of ventilating which is used is so cheap as these end ventilators, which cost absolutely nothing excepting the labor of putting them in and the cost of the little wood, paint and varnish of which they are made. Registers are, we believe, now made by some manufacturers for this especial purpose, and in some cases the opening is closed by a sash glazed with ground glass on which are painted directions to passengers to keep it open if they want to breathe pure air. This latter device is very effective on the Boston & Albany Railroad, where it is used.

One other consideration should be kept in mind in providing the means of heating cars, that is, of course, safety to passengers in case of accident. The most effective means of preventing stoves from communicating fire to cars in a collision seems to be simply to fasten them to the floor so that they will not be overturned with the cars should the latter meet with such an accident. It is also important that the stoves themselves should not be shattered to pieces by the concussion of a collision, and we have often wondered that manufacturers have not made and offered for sale simple stoves for burning wood and coal and made of thin boiler plate. These, if made of good material, would probably withstand any concussion to which they might be subjected.

THE RAILROADS OF PENNSYLVANIA.

The immense volume published by the State of Pennsylvania entitled "Auditor-General's Report on Railroads, Canals and Telegraphs," that for 1873, lately issued, consisting of more than a thousand large octavo pages, being considerably larger than Poor's Manual, consists almost entirely of a mass of figures, with hardly a line of text and not one word of comment. Nine hundred of its pages are covered with the separate reports of the companies, and the remainder, in which the work of the State officer is contained, consists of a series of tabulated results compiled from these reports, containing nearly all the separate items given in them except the accounts of accidents and the lists of directors and officers, and in some cases footings which show the aggregates for all the railroads of the State. The work is, however, one of compilation rather than computation, and it often requires a great deal of labor to obtain from it facts which the returns really cover. The form of report required from the railroad companies is nearly identical with that used for the reports made to the State Engineer and Surveyor of New York, of which it may be said that for the most part it is good as far as it goes, but does not go far enough. It has nothing comparable to the completeness and elaboration of the Massachusetts reports—which are probably the best in the world, unless those of some of the German States excel them: they are certainly very much better than the English, French or Belgian reports—; but a more lamentable defeat is a presumable want of accuracy. In New York and Pennsylvania the business of receiving and compiling these reports falls upon officers whose chief attention must necessarily be given to other matters, and who seem to be without authority to compel attention to the requirements of the law and insist that the accounts be kept in such a way as to afford accurate information on every point called for. It seems to be the practice to accept whatever a company may hand in as its "report" and to ask no questions for conscience's sake. The result is that those companies which do not care to keep accounts for their own purposes of the matters they have to report on are likely to do the work in the easiest way, by putting down such figures as they have on their books and guessing at the rest. The only way to secure accurate returns is to examine them critically, call attention to all loose or suspicious statements, and insist on having them corrected, and, if the company has not been in the habit of keeping records which give all the information, to insist that they do keep such records hereafter. The Massachusetts Commissioners have had very great difficulty in securing completeness and accuracy in their reports, and indeed doubtless have not succeeded entirely in spite of all their efforts; but they have at least demonstrated that

PLATE 13.

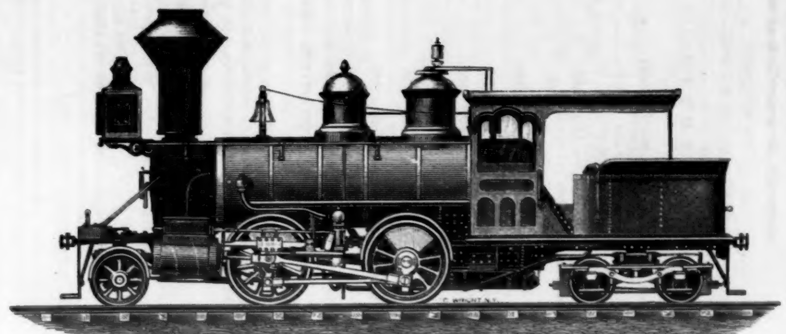


DOUBLE-END LOCOMOTIVE,

BY THE GRANT LOCOMOTIVE WORKS, PATERSON, N. J.

Scale, ⅝ in. = 1 ft.

PLATE 14.

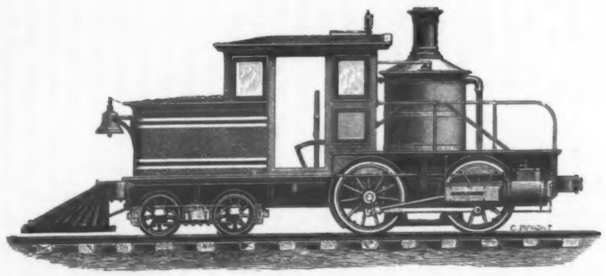


DOUBLE-END TANK LOCOMOTIVE,

BY THE ROGERS LOCOMOTIVE & MACHINE WORKS, PATERSON, N. J.

Scale, ⅝ in. = 1 ft.

PLATE 15.

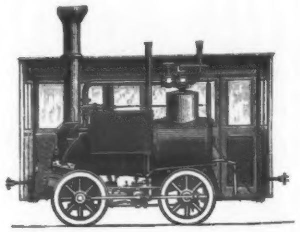


LIGHT TANK LOCOMOTIVE,

DESIGNED BY M. N. FORNEY, 73 BROADWAY, NEW YORK.

Scale, ⅜ in. = 1 ft.

PLATE 16.

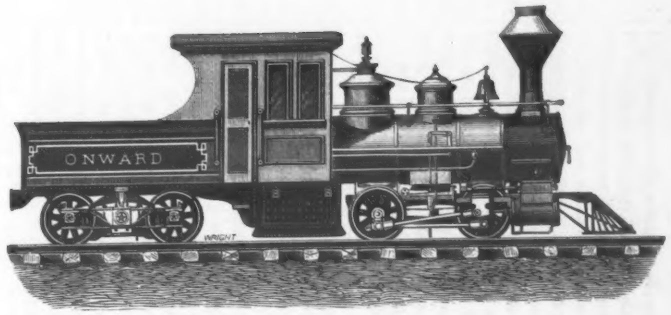


LOCOMOTIVE FOR N. Y. ELEVATED RAILROAD,

BY JUAN G. RIBON, JERSEY CITY, N. J.

Scale, ⅜ in. = 1 ft.

PLATE 17.



DOUBLE-TRUCK NARROW GAUGE LOCOMOTIVE,

BY THE MASON MACHINE WORKS, TAUNTON, MASS.

Scale, ⅜ in. = 1 ft.

such reports are sure to be very inaccurate unless the collecting office takes great pains to have them otherwise.

To translate some of the tables of this bulky report into a connected statement concerning the railroad system, we will say that it has returns from 144 different railroad corporations. Of the 137 which report "characteristics of road," 16 had no track laid at the close of 1878. The others had 6,655,34 miles of main line, of which 4,527.19 miles was in Pennsylvania, and 1,597.17 miles of branches, of which there is no division between the mileage in Pennsylvania and that in other States; but an examination of the table indicates that the companies have not reported any mileage of branches outside of Pennsylvania. They report also (and this we suppose to include all they have in and out of Pennsylvania, 1,819.83 of double track and 2,218.43 miles of sidings, which indicates that 22½ per cent. of their mileage has a double track, and that there is 27 miles of sidings for every hundred of main and branch track.

The cost of these companies' roads (whose aggregate length is 8,252.56 miles) with their equipment is reported at $621,312,049, or $75,300 per mile, nearly. The report shows that the capital stock paid in at the close of the year was $478,701,874, the funded debt $378,590,370, the floating debt $37,601,158. Fifty companies paid dividends varying from 1 to 20 per cent.

No less than 1,259 miles of the road reporting is of 6-feet gauge; but not half of this is in Pennsylvania, as the Atlantic & Great Western and the Erie report the whole of their main lines. There were 60 miles of 3-feet gauge and 6 of 3 ft. 3 in., 52 of 4 ft, 3 in. on two roads, besides another whose length of that gauge is not given, a fraction of a mile (in two different inclined-plane roads) of 5-feet gauge, while the rest is of standard gauge, though varying from 4 ft. 8½ in. to 4 ft. 10 in.

The equipment consisted of 4,054 locomotives, which is one to 2.02 miles of road; 1,173 first-class, 257 second-class, 757 baggage, mail and express, 58,744 freight and 79,438 coal, ore, stone and tank cars. There were thus 138,182 freight cars, which is at the rate of 16.7 cars per mile of road—a greater number, doubtless, than on the roads of any other State, caused by the enormous mineral traffic of Pennsylvania, coal, ore and iron affording the largest traffic.

An interesting item is the length of steel track, which is 1,974 miles—just about 16 per cent. of the total length of track, including second track, branches and sidings.

The total train mileage reported for the year is about 106,000,000 of miles—which, we may observe, is greater than the distance from the earth to the sun—three-fourths of which was made by freight and coal trains. the coal trains making about 9¼ per cent. of the whole.

The materials of traffic, indeed, are among the most important information given, and they present a striking contrast to the reports from Western, from New England or even from New York roads. The articles are classified under fourteen heads, but three of these are coal, one being given for anthracite, one for bituminous, and one for both, for those lines which do not report anthracite and bituminous separately. Now we find from this that *forty-nine* per cent. of the total tonnage moved on the Pennsylvania railroads in 1873 was coal, just two-thirds of it being anthracite, besides that reported with bituminous. The total of mineral products was 61½ per cent. of the whole traffic. There is nothing like this in any other State in this country, and we doubt if there is elsewhere in the world, where more than three-fifths of the traffic is in unmanufactured minerals. Of course a very large share of this traffic was created by the iron industry, but the product of this industry forms a smaller portion of the whole bulk of traffic than might be supposed, being only about 3 per cent. Doubtless, however, the average distance that the manufactured iron was carried was several times as great as the average haul of coal and ore, and the mere bulk of the materials, as here recorded, is never an accurate gauge of the amount of traffic—the number of tons hauled one mile being the true criterion. Other merchandise and manufactures formed 19 per cent. of the tonnage, and live stock and agricultural products, which give most of our Western roads their only adequate reason for existing, is but 7 per cent. of the whole.

The receipts for the year were (very nearly) $148,000,000, of which 19 per cent. was from passengers and 72½ per cent. from freight, about 2½ per cent. from mails and express, and the balance from miscellaneous sources. These earnings are at the rate of $16,965 per mile of road, and are larger than in any other State.

As there appears to have been at the close of the year 5,854 miles of railroad in the State, and it has an area of 46,000 square miles, there is one mile of railroad for 7.86 square miles of area, and if the mileage was distributed regularly in parallel lines all over the State, no inch of ground in it would be more than 3.93 miles from a railroad. No purely agricultural country could support such a system; but besides the immense mineral traffic and the manufactures, of which but a fraction is consumed in the State, and the cost of whose transportation, therefore, is paid by consumers out of the State, a very large part of the other traffic of the United States passes through Pennsylvania and helps to support its railroad system. Few districts in the world present such a field for transportation enterprises, and in few has the field been so fully worked. A portion of the mineral traffic is more fluctuating probably than agricultural traffic; but a very large part of it is in fuel for domestic consumption, which varies but little be the times good or bad; and in the long run the mineral traffic developed by the iron industry grows rapidly. The roads which depend chiefly or largely on this will have their seasons of depression; but after an existence of a few years they may usually be well prepared to meet and defy them.

Texas Cattle Traffic.

A correspondent of the New York *Times* has collected some interesting statistics of the Texas cattle traffic, limited however to that part of it which passes through Kansas City, and excluding therefore whatever may be carried by the roads leading directly to Texas, that is the Missouri, Kansas & Texas and the St. Louis, Iron Mountain and Southern.

It seems that, notwithstanding an unsatisfactory return from last year's business, this traffic has increased largely this season, a single road (the Atchison, Topeka & Santa Fe) having carried during the first half of this year very nearly as many cattle as the total receipts at Kansas City from all lines during the whole of 1873, while the Kansas Pacific, heretofore carrying more than all other roads combined, has suffered no decrease, but has had an increase of nearly one-half in its cattle traffic for the first seven months of the year. The figures are:

	1873.	1874.
Atchison, Topeka & Santa Fe (6 months)......	18,448	26,656
Kansas Pacific (7 months)......	54,320	196,368

The most remarkable feature of the traffic, however, is the sudden leap of the Atchison, Topeka & Santa Fe to the first position as a carrier of Texas cattle, and that position so far in advance as to distance all competitors. Last year, as we have said, the Kansas Pacific carried to Kansas City nearly three times as many cattle as were shipped over the Atchison road. This year, if the *Times*' correspondent's figures are correct, the latter carried in six months seven and a half times as many as the Kansas Pacific. The relative positions of the two roads would seem to explain this diversion sufficiently if this traffic was affected by the distances of the shipping stations like ordinary traffic, for the Atchison, Topeka & Santa Fe stock stations are two, three and four days' drive nearer Texas than the Kansas Pacific's. But the Texas cattle traffic bids defiance to distances apparently, where there is good pasturage on the route: else why should the drovers take their cattle entirely across the Indian Territory, and perhaps twice as far in Texas, when by a drive not a quarter as long they can reach railroads eager to carry their cattle through? The reason was very well explained by Mr. Elliott, the Industrial Agent of the Kansas Pacific, in a letter which we published about two years ago in reply to some remarks in which we intimated that the completion of the new roads through to Texas would probably put an end to the largest part of the Kansas shipments of Texas cattle. Mr. Elliott said that the drive northward is in reality quite as much a feeding of the cattle as their transportation. They move too slowly to be injured and for the most part at a time when the Texas pastures are poor, so that the movement is to better pastures as well as to a market. Why they should decline to go further when they have reached the Atchison, Topeka & Santa Fe, we are unable to say; but it is not unreasonable to suppose that people who have driven their cattle five hundred miles and got them to a railroad in good condition will generally prefer not to drive them forty or fifty miles further, even if the pastures are ever so good. If the Kansas pasturage should happen to be poor any season, of course the cattle would generally be shipped as soon as possible.

Although we have as yet no returns from the railroads which run through to Texas, the fact that the business of the Kansas roads have increased instead of decreasing would indicate that they have not so far diverted any considerable portion of the cattle traffic. One might suppose that the Missouri, Kansas & Texas might get a large share of the driven cattle by establishing a shipping station somewhere in the northern half of the Indian Territory, if that is practicable.

Not the least important feature of this year's traffic is the large proportion, said to be about one-fourth, which goes westward, chiefly to Colorado and Wyoming. These for the most part are stock cattle, which, within a year in most cases, will be shipped eastward in condition for market. The only profitable use that can be made of a vast territory about two hundred miles west of Kansas City and Omaha is for grazing, and the stocking of it is a very favorable sign and likely to be of notable advantage to the railroads through that wilderness. Of the great number of cattle pastured in Kansas during this summer, most must be marketed this season or sent to States further east to winter, the Kansas corn and hay crops being insufficient for such a purpose, and so they may make a market for part of the surplus corn of Iowa and Illinois.

It is not impossible that there will be considerable changes hereafter in the currents of the Texas cattle traffic. If, as is said, Texas cattle are for the most part not in condition for market when they leave the State, and therefore need to be driven through good pasturage northward in order to fatten, probably when proper facilities for shipping at low rates have existed for some time a portion at least will be got into condition in order to take advantages of these facilities, for we believe that no one pretends that cattle cannot be fattened in Texas, and Texans are in the habit of extolling their beef. Moreover, though the roads in Texas are very much nearer the chief cattle district than the Kansas roads, none of them penetrate it as yet. Two of them hope to do so within a year, and then doubtless we shall see whether the cattle will persist in walking to market.

Preliminary Trial Trip of the Pacific Mail Steamship Company's Steamer City of Peking.

This vessel is one of a pair built by Messrs. John Roach & Son for the Pacific Mail Steamship Company during the past year. The mate, the City of Tokio, has been launched, and is now receiving her machinery and equipment at the Morgan Iron Works in this city.

These vessels are designed to meet the requirements of a law passed in 1872, granting the company a large subsidy for carrying the United States mails between the United States and China and Japan, but stipulating that the mails should be carried semi-monthly in American iron vessels of more than 5,000 tons burden.

The following are the principal dimensions of the ship:

Length over all....................................	420 feet.
Length on load line....................................	407 "
Breadth of beam....................................	47 "
Depth of hold....................................	28½"
Tonnage....................................	6,000 tons
Displacement at low draft of 23 feet aft and 21 feet forward.	7,150 "
Midship section at same draft....................................	882 feet.

As the trip to be made by these vessels is a very long one (6,000 miles), in order to avoid the possibility of the ship being disabled at sea by the breaking down of a portion of her machinery and having to make her many thousands of miles to the nearest port under sail alone, through a region of almost perpetual calms, it was decided to furnish the ship with two complete sets of machinery.

In case of one set breaking down the other will suffice to drive the ship at a very slightly reduced speed.

There are two similar pairs of compound engines, each engine having separate condenser, air and circulating pumps and all attachments as though they had been placed in separate vessels.

The steam to work the engines is furnished by two sets of boilers, each set having separate smoke-stacks, superheaters, coal-bunkers and all appurtenances, so that either set may be worked independently of the other.

The engines are of the general plan, developed by the late John Elder, and previously adopted by the Pacific Mail Steamship Company on their vessels the Colon, Acapulco, Grenada, City of Panama, City of Guatemala and Colima, in all of which they have given perfect satisfaction during the past year.

The steam formed in the boiler passes first through the superheater, where it is freed from the water mechanically held in suspension and superheated about 20°; thence to the high-pressure cylinder, where it is admitted during about one-quarter of the stroke at a pressure of nearly 55 lbs. above the atmosphere, the difference between this and the boiler pressure of 60 lbs. having been lost in the long steam-pipe and the intricate passages through the valves.

It is expanded during the balance of the stroke to a pressure of 7 lbs. above the atmosphere, and allowed to escape into a reservoir called a "receiver," from which it is drawn to supply the low-pressure cylinder, being admitted during nearly one-half the stroke at a pressure of 5 lbs. above the atmosphere, and expanded to a pressure of 10 lbs. above zero.

From the low-pressure cylinder it passes to the condenser, and after condensation is returned to the boiler.

The object of the use of a pair of cylinders in place of a single one being to divide the strains upon the machinery into two parts.

The following are the principal dimensions of the engines:

Diameter cylinders, high pressure 51 inches, low pressure 88 inches.

Stroke of pistons....................................	4 ft. 6 in.
Diameter of crank shaft....................................	18 in.
Diameter of line shaft....................................	17 in.
Diameter of propeller shaft....................................	19 in.
Diameter of crank pins....................................	16 in.
Length of crank pins....................................	16½ in.
Diameter of screw propeller....................................	18 ft.

Pitch, greatest 33 feet, least 27 feet, mean 30 feet.

There are ten cylindrical boilers, having three furnaces each, the products of combustion returning through tubes over the furnaces.

Diameter of boilers....................................	13 ft.
Length of boilers....................................	10 ft. 6 in.
Thickness of shell....................................	13-16 in.
Total grate surface....................................	520 sq. ft.
Total heating surface....................................	16,500 sq. ft.
Total superheating surface....................................	1,400 sq. ft.
Number of smoke stacks....................................	2
Diameter of each....................................	8 ft. 6 in.
Height above grate....................................	70 ft.

The ship is provided with steamsteering gear as well as two sets of hand steering gear, one forward and one aft.

There are also ventilating pipes carried all through the hold through which the foul air is exhausted by a free and independent steam-engine, its place being supplied by pure air from the deck.

There are accommodations for 150 cabin passengers and 1,800 steerage passengers, and there can be carried in the bunkers 1,500 tons of coal.

On the trial trip the draft of water was: forward, 13 feet; aft, 18 feet. The object was to wear the journals smooth by running slowly, and to test the performance of the ship and machinery at sea. The ship left Pier 42, at 10:30 A. M., on Monday, the 17th inst., and ran down the bay through the Narrows and to sea, down the coast past Long Branch and, returning, arrived abreast Pier 42 at 8 P. M. The speed of the ship was 10¾ knots per hour, and the horse-power developed 1,500, from which it may be deduced that the speed of the ship would have been, if the maximum power had been developed, 13,000 horse-power, 14¾ knots, equivalent to 17 statute miles per hour.

Agriculture in Illinois.

Complete returns of the county assessments of the State of Illinois for the current season shows that the cultivated grounds of the State embraces 13,881,302 acres, of which 3,543,-

214 acres were in wheat this season, 7,332,924 in corn, 1,824,-689 in oats, 1,363,914 in meadows, and 819,561 in other crops. The area of the State is more than 35,000,000, so that less than two-fifths is in cultivation. It would be an error, however, to suppose that no use is made of the other three-fifths: to say nothing of the wooded land, which is considerable, nearly all the unplowed prairie is pastured or mowed, and stock growing is really the great industry of the State. This is evident from the fact that the same returns show more than two millions of horned cattle in the State, which of themselves would require four times the grass land reported in meadow.

As indicative of the material for transportation which these crops may afford, we will calculate roughly the probable production, which will be about 30,000,000 bushels of wheat, more than 250,000,000 bushels of corn, and about 60,000,000 bushels of oats. Probably nearly half of the wheat will be consumed in the State; but only a small fraction of the corn will go out of it in the shape of corn. There are about three and a half millions of hogs to eat it, besides the two million cattle, a million horses and mules and a million sheep. But the surplus will doubtless give a great deal of work to railroads and vessels.

The acreage of wheat reported is one-fourth larger than any year since 1870, when it was nearly as large; the corn acreage has increased steadily for five years and is this season nearly 5 per cent. greater than in 1873 and 29 per cent. greater than in 1869. During the same time there has been an increase of nearly one-third in the number of cattle and of more than one-half in the number of hogs in the State, while sheep are fewer by 30 per cent.

The returns show altogether a really rapid increase in the area cultivated, considering that the State has been so long accessible in nearly every part to markets. And it is probable that it will continue to grow when districts nearer the border of civilization make little progress.

Record of New Railroad Construction.

This number of the Railroad Gazette has information of the laying of track on new railroads as follows:

Martha's Vineyard.—Completed by the laying of track from Oak Bluff southward 8⅝ miles to Katama, on the Massachusetts island from which the road takes its name (of 3-feet gauge). *Visalia Branch.*—Completed from Visalia, Cal., westward 7⅛ miles to the Southern Pacific Railroad.

This is a total of 15⅝ miles of new railroad, making 932 miles completed in the United States in 1874, against 2,128 miles reported for the same period in 1873 and 3,792 miles in 1874.

The New York Ticket Sellers have announced their policy with regard to the railroads which refuse to pay commission. As the railroad companies refuse to revoke their action, and the ticket sellers cannot find any one to pay them for diverting to it the business of its neighbors, they have decided to do it for nothing, it seems. So they announce that they will use their influence to send all the business possible to the New York Central & Hudson River, the Lake Shore & Michigan Southern, and the Chicago, Rock Island & Pacific, apparently choosing the lines which need the least help, or, rather, hoping to injure those which they think are likely to suffer most from any diversion of trade. This policy they say they propose to follow for a year if the railroad companies do not surrender sooner. If the railroads will hold out until these people get tired of working for nothing, we presume they will have no further trouble from "scalpers," unless they make it themselves, which is by no means impossible.

The Petroleum Exports of the United States, including only those from the ports of Boston, New York, Philadelphia and Baltimore, which, however, cover nearly all except the exports to Canada, were from the beginning of this year down to August 15, 149,577,003 gallons, weighing about 400,000 tons. There is probably no produce which is carried great distances of which the cost of transportation forms so large a part of the average price to the consumer. Crude oil at Tideoute, Pa., August 15, was quoted at 72¼ cents per barrel of about 160 pounds, being a value of only 0.453 cent per pound, or $9.06 per ton. Coal cannot properly be compared with it, for it is not carried from one country to the four quarters of the globe, like petroleum. Corn, to be as cheap, would have to sell for 25 cents per bushel—as it does sometimes far from water transportation in seasons of great plenty, but not often; and corn is not carried so far as petroleum and on the average not one-tenth as far.

The Metropolitan Railway, which is the chief of the London underground railroads, carried during the first half of this year 21,560,248 passengers, and received for this service and a considerable freight service besides $1,003,740 gold. The working expenses were 41⅛ per cent., and surplus was sufficient to pay a dividend of 1¼ per cent. on the stock. The traffic of the line has been almost stationary since 1870, and was for the last half year at the average rate of 113,600 passengers per day—enough to fill about 2,250 ordinary American cars and make 110 heavy trains each way daily.

The "Metropolitan District" Railway, another London underground line, carried 10,223,830 passengers during the first half of this year, earned no dividend on its common stock and only 1 per cent. on its preferred stock.

Fast Time in Germany, as the English railroads count fast time, has been almost unknown heretofore, but by the 1st of next month it is reported that a train is to run between Berlin and Hamburg, 170 miles, in 3¼ hours, or at the astounding rate of 52⅓ miles per hour, including three stops for water. Heretofore the trains have taken six hours to make this trip, but they had to stop at twenty-three intermediate stations instead of three.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—The Chicago & Northeastern Railroad Company was organized recently at Lansing, Mich., by the election of the following directors: James M. Turner, F. M. Coles, Wm. H. Chapman, Lansing, Mich.; Isaac Gale, Shiawassee, Mich.; W. R. Bowes, Michigan City, Ind. The board elected James M. Turner, President, and W. R. Bowes, Secretary and Treasurer.

—The new board of directors of the Atlantic & Pacific Railroad Company has elected Andrew Pierce, Jr., President and General Manager. Mr. Pierce has been Vice-President and General Manager. Col. Thomas A. Scott, who was President last year, declined a re-election either as President or director. The board chose Mr. D. R. Garrison, of St. Louis, Vice-President, and re-elected Clinton B. Fisk, Secretary and Treasurer.

—The following directors have been chosen to fill vacancies in the board of the Lafayette, Bloomington & Mississippi Railroad Company: G. Bogardus, Paxton, Ill.; W. H. Riggs, Saybrook, Ill.; C. Ridgely, Springfield, Ill.

—At the annual meeting of the Jacksonville, Northwestern & Southeastern Railroad Company held in Jacksonville, Ill., August 18, the following directors were chosen: A. E. Ayers, M. P. Ayers, W. S. Hook, Jacksonville, Ill.; John C. Salter, Waverly, Ill.; Joseph H. Dun, Wm. Elliott, Philadelphia; H. N. Titus, New York. The board elected M. P. Ayers, President; H. N. Titus, Vice-President; W. S. Hook, Treasurer.

—At the annual meeting of the Lamoille Valley Railroad Company in Hyde Park, Vt., August 11, the following directors were chosen: Franklin Fairbanks, J. D. Bell, G. W. Hendee, W. Brigham, O. Buck, R. S. Reed, D. D. Wead, A. B. Jewett, O. Abel, D. W. Aiken, J. H. George.

—Mr. David Edwards has been appointed General Freight Agent of the Flint & Pere Marquette Railroad, with headquarters at East Saginaw, Mich. Mr. Edwards was recently Superintendent of the Canada Southern lines west of the Detroit River and before accepting that position was Freight Agent of the Michigan Division of the Lake Shore & Michigan Southern.

—The new board of directors of the Nashville, Chattanooga & St. Louis Railroad Company has elected the following officers: President, E. W. Cole; General Superintendent, J. W. Thomas; Resident Engineer, R. C. Morris; Secretary and Treasurer, R. C. Bransford; General Bookkeeper, T. D. Flippin. The only change from last year is the appointment of Mr. Bransford in place of W. A. Gleaves, who declined re-election. The office of General Agent has been dispensed with.

—At a meeting of the St. Louis & Western Railroad Company held in St. Louis, August 11, the stockholders elected C. L. Hunt, S. B. Shaw, E. D. Eaton, B. R. Bonner, Wm. Follenius, Edward Burgess and L. Benecke directors. Subsequently Chas. L. Hunt was elected President; S. Dwight Eaton, Vice-President, and S. B. Shaw, Secretary and Treasurer.

—Mr. B. S. Fitch has been appointed General Freight Agent of the Chesapeake & Ohio Railroad, in place of Mr. M. W. Goss, resigned.

—Dr. A. H. Davega, is President of the Chester & Lenoir Railroad Company.

PERSONAL.

—Mr. Charles G. Sisson, President of the Northern Railroad Company of New Jersey, and formerly a well-known railroad contractor, died at his residence in Tenafly, N. J., August 21. He built the Northern road as contractor, was always a director and the largest stockholder. He was also one of the contractors for the building of the Erie tunnel through Bergen Hill, and narrowly escaped being killed by some of his men in the tunnel riots in 1858. He was connected with the Erie in various ways and was a warm supporter of the Fisk and Gould party in the management. He was for a time owner of the Paterson & Newark road, having bought it at sheriff's sale. He left an estate estimated at $7,000,000.

—Col. W. Milner Roberts, Chief Engineer of the Northern Pacific Railroad, sailed for Liverpool in the Scotia on the 19th.

TRAFFIC AND EARNINGS.

—The earnings of the Great Western Railway of Canada for the week ending July 31 were: 1874, £17,859; 1873, £23,064; decrease, £5,205, or 22⅛ per cent.

—The earnings of the Grand Trunk Railway for the week ending August 1 were: 1874, £36,300; 1873, £35,700; increase, £600, or 1⅞ per cent.

—The earnings of the Chicago, Milwaukee & St. Paul Railway for the second week in August were: 1874, $134,900; 1873, $138,600; decrease, $3,700, or 2¾ per cent.

—The earnings of the Michigan Central Railroad for the second week in August were: 1874, $116,645; 1873, $112,218; increase, $4,427, or 4 per cent.

—The earnings of the Toledo, Wabash & Western Railway for the second week in August were: 1874, $119,021; 1873, $144 925; decrease, $25,904, or 17⅞ per cent.

—The Kansas Pacific Railway during the seven months ending July 31, 1874, carried 1,666 car loads (26,650 head) of cattle against 1,153 car loads (18,450 head) in 1873, an increase of 44⅛ per cent.

—During the first six months of 1874 the Atchison, Topeka & Santa Fe road carried 196,368 head of cattle against 54,320 head for the same period in 1873, an increase of 261⅛ per cent.

—The Utah Central Railroad carried during July 8,943 tons of freight, including 2,383 tons of coal and coke.

—The Utah Southern Railroad carried in the month of July 7,781 tons of freight, the principal items being: ore and bullion, 2,786 tons; coal and coke, 1,427 tons; iron ore and limestone, 726 tons.

—The earnings of the Denver & Rio Grande Railway (main line, 118 miles) for the second week in August were: 1874, $8,217; 1873, $8,323; decrease, $106, or 1¼ per cent.

—The earnings of the Indianapolis, Cincinnati & Lafayette Railroad for June were: 1874, $142,560; 1873, $160,456; decrease, $17,896, or 11⅛ per cent.

—Of the grain shipment from Buffalo during the week ending August 15, one-third was by rail and two-thirds by canal.

—The earnings of the Chicago, Milwaukee & St. Paul Railway for the third week in August were: 1874, $146,000; 1873, $141,345; increase, $4,655; or 3¼ per cent.

—The earnings of the Great Western Railway of Canada for the week ending August 8 were: $1874, £18,503; 1873, £20,193; decrease, £1,690, or 8⅜ per cent.

—The earnings of the Grand Trunk Railway for the week ending August 8 were: 1874, £39,400; 1873, £39,000; increase, £400, or 1 per cent.

—The much talked of trade between Kansas City and Galveston has been commenced by the shipment of 15,000 bushels of Kansas wheat from the former place, which is to go to Galveston by rail and be there transferred to ship for Liverpool. This consignment is intended as an experiment to show the actual cost at which grain can be laid down over this route, the time required, the effect of changes of climate, the English interest, and other points, and to determine the practicability of establishing an extensive trade by this route.

THE SCRAP HEAP.

Railroad Manufactures.

The Watson Manufacturing Company at Paterson, N. J., has secured the contract for the Broadway bridge over Fort Point Channel in Boston. The draw will be 160 feet long with a 40 feet roadway and two 10 feet sidewalks. They have also received contracts for a $22,000 highway bridge over the Passaic River near Paterson, and a number of small bridges on the Hackensack Extension road.

The Skinner & Gifford Manufacturing Company at Dunkirk, N. Y., make frogs, switches, hand, push and dump cars, steel scrapers and other railroad and contractors' supplies, including turn-tables.

The Kimball Manufacturing Company, of San Francisco, is building the cars for the new North Pacific Coast (narrow-gauge) Railroad.

The Patten Car Works at Bath, Me., are at work on some passenger coaches for the Intercolonial Railway.

Porter & Stenton, of Cincinnati, are filling several orders for light rails for Georgia and Alabama.

The Cleveland Boiler Plate Company is building a large sheet mill with two sets of rolls and will manufacture sheet iron of all grades. The company now makes boiler iron, fire-box plates, tank iron and plate iron of all kinds.

British Exports of Cars.

During the month of July last the exports of railroad cars from Great Britain were of the declared value of £96,394; from July of the previous year, £63,011.

OLD AND NEW ROADS.

Continued from page 333.

Delaware, Lackawanna & Western—Morris and Essex Division.

The Chancellor of New Jersey has decided in favor of the validity of the title to the Bacot property on Bergen Hill, a portion of which was purchased by this company for its new tunnel. The company will therefore not be obliged to begin condemnation proceedings, and has already commenced to pay the present holders according to its previous agreement.

Lafayette, Muncie & Bloomington.

In the suit brought by certain stockholders to set aside the lease to the Toledo, Wabash & Western, the Circuit Court at Lafayette, Ind., has granted a motion to strike out of the complain. the Illinois law of 1865, which forbids any railroad company of that State to take a lease of any road out of the State without having first obtained the written consent of all stockholders resident in Illinois. The other questions in the suit have already been decided against the plaintiffs. The case will be taken to the Supreme Court.

Chicago, Burlington & Quincy.

The location of the new bridge over the Mississippi at Clinton, Ia., is being staked out by the engineers of this company. The bridge is to be partly truss, partly trestle and principally a pontoon bridge. The company has secured the right of way through Clinton on the Iowa side of the river from the bridge to the Chicago, Clinton & Dubuque track. The contract for the bridge will be let in Boston soon.

Springfield & Illinois Southeastern.

This road is to be sold at Springfield, Ill., September 15, under a decree of foreclosure of the first mortgage granted by the United States Circuit Court. The smallest bid which will be accepted is $1,000,000, and payment must be made in cash or in bonds *pro rata*, that is each bond will be accepted only for such fraction of the purchase money as it forms of the whole issue of bonds.

The road is 228 miles long, from Beardstown, Ill., southeast through Springfield to Shawneetown on the Ohio. The first-mortgage bonds outstanding amount to $3,400,000.

Wisconsin Valley.

The President, Mr. James F. Joy, recently visited Wausau, Wis., and proposed to the people of that place that they should take $20,000 of the bonds of the company, provided it should decide to extend the road from Knowlton to Wausau this year. The proposal was accepted and nearly all the bonds taken on the spot. It is probable that this 18 miles of road will be built at once.

Chicago & Northeastern.

A company by this name has been organized at Lansing, Mich., for the purpose of building a railroad, 47 miles long, from Lansing east by north to Flint, to connect the two divisions of the Chicago & Lake Huron. It is designed to begin work at once.

Baltimore, Pittsburgh & Chicago.

A considerable part of the grading from South Chicago to Parkside, where the connection with the Illinois Central is made, has been finished and about a mile of track laid down. Two cargoes of iron and 50,000 ties have been received. The ground chosen for the shops has been tested and found to give a good foundation, and work on the buildings will, it is stated, be begun at once. The round-house will be located at Eighty-seventh street, will be 268 feet diameter and will hold 40 engines.

The Osage Ceded Lands.

A letter is reported to have been received at Lawrence, Kan., August 21, from Judge Dillon announcing that the decision of the United States Circuit Court in the Osage ceded land cases is in favor of the settlers. These cases cover the title to about 1,000,000 acres of land on which there are a very large number of settlers, and which are claimed by the Missouri, Kansas & Texas and Leavenworth, Lawrence & Galveston companies. The suits will most probably be carried up to the Supreme Court.

New York & Oswego Midland.

The Utica (N. Y.) *Herald* of August 21 says: "The difficulties of the Midland have increased so rapidly of late that the public need not be surprised if it shall learn that the road has suspended business altogether, pending the sale on foreclosure. The current receipts under the present management have not been sufficient to pay the running expenses of the road, much less its rapidly accruing obligations. The employes have not been paid since the 1st of June. Receiver Hewitt recently issued a circular apologizing for further delay on the ground that the Delaware & Hudson Canal Company had refused to pay over some $35,000 due to the road for coal transportation. The company's excuse for this refusal is based upon the fact that the Midland has failed to pay the semi-annual rental for the Utica, Clinton & Binghamton Railroad and the Rome & Clinton Railroad. The Canal Company is the surety of the Midland in the lease of these roads, and expects to be obliged to make good the overdue rental. This amounts to $47,000, the total rental for the two roads being $94,000 a year. On the 26th of this month the 60 days expire which the law allows to the Midland Railroad to make good its obligations under the lease. We have the best of reasons for

believing that, upon that day, the Delaware & Hudson Canal Company will take possession of the Clinton roads and thereafter run them. News reached this city yesterday that an adjustment of the difficulties between the two companies had been effected. What the terms of this adjustment are it was impossible to discover, except that the Hudson Canal Company will not pay the Midland the $35,000 which it owes on coal freights. If it had been otherwise, the paymaster of the Midland would be under instructions to pay the employes the full amount past due to them. As it is, the car starts to-day to pay the men one-sixth of their back wages. Yesterday the Midland Company resumed the transportation of the Canal Company's coal, after refusing to carry it for three days.

"The surrender of the Clinton Branch is just now looked upon as the best thing that can happen to that road. No repairs have been put upon it since the commencement of the lease, and the whole line is in a most wretched condition. Many tons of new rails are needed, as well as some 10,000 new ties, to make it safe for the winter.

"The branches from Utica to Smith's Valley, and from Rome to Clinton, have paid a handsome profit above their expenses. This is more than can be said of the main road. * * * It is not anticipated that the sale of the road will be made before the close of the year. Meanwhile the first-mortgage bondholders have as yet united upon no plan of action regarding the purchase of the road, or the securing of their bonds. Its early suspension would be an advantage to them by decreasing the amount of indebtedness which is now daily increasing, and whose payment is contemplated in all plans of reorganization yet suggested. There is no doubt in our minds, as there never has been, that the Midland Railroad can ultimately be brought into a condition where it will pay the interest on a limited amount of indebtedness, and prove of great benefit in developing the country through which it runs. But great changes must be effected before that day arrives."

Hackensack Extension.

Work is in progress on the extension of this road from the present terminus at Spring Valley, N. Y., on the Piermont Branch of the Erie, northeast to Haverstraw.

Rockford, Rock Island & St. Louis.

The Frankfort *Journal* has the following report of a meeting of the Rockford, Rock Island & St. Louis bondholders, held at Frankfort-on-the-Main, August 6:

"The meeting called by the Committee took place August 6. Dr. Fester presided. M. Osterberg made a full report concerning the action of the Committee and his own work while acting as delegate in America. He laid particular stress upon the fact that the prospects were very good for the bondholders, despite the efforts of M. Cable in America and those of his party on this side. The meeting, after a protracted discussion, resolved 'that the Committee of the Rockford, Rock Island & St. Louis Railroad bondholders be directed to prosecute the suit against the management of the road with all energy; to purchase the road, if it should be sold, for the bondholders represented in the Committee; to either lease it to a responsible company, subject to the approval of the bondholders, or to run it for account of the bondholders.' Messrs. Ph. Petsch (firm John Goll & Sons) and Henry Seligman (of Seligman & Stettheimer), were appointed on the committee in place of Messrs. Consul Murphy and Consul Wolf, who had resigned."

Boston & Providence.

The following order to engineers has been issued:

"Upon recommendation of the Railroad Commissioners, both of Massachusetts and Rhode Island, a great reduction will be required in the use of the whistle on our locomotives. You will therefore, after midnight of August 22, discontinue its use for all purposes, except for a special danger signal. It will not be used in passing other trains, or in approaching crossings or stations, except those regarded as specially dangerous, and in case of freight trains where it is necessary to inform station agents and switchmen that the train will have work at such station. In all other cases the signal must be given by the ringing of the bell."

Pennsylvania—Belvidere Division.

The long wooden bridge at Prallsville, N. J., was destroyed by fire August 21, a spark from a locomotive being the supposed cause. The bridge was not rebuilt until August 24, all passengers in the meantime being transferred.

Visalia Branch.

Tracklaying on this road is completed and construction trains have passed over the line, which is 7½ miles long, from Visalia, Cal., westward to a connection with the San Joaquin Valley line of the Southern Pacific. It will be operated by the Central Pacific.

Kansas Midland.

Tracklaying was commenced at Kansas City, August 19, on the line from that place to De Soto, Kan., about 25 miles west by south, from which place the St. Louis, Lawrence & Western track will be used to Lawrence. The road will be parallel with and but three or four miles south of the Kansas Pacific, separated from it by the Kaw River.

Union Pacific.

The Land Department reports sales for July of 22,005.54 acres for $100,558.07, an average of $4.57 per acre. The total sales up to July 31 were 1,035,784.90 acres for $4,719,367.79, an average of $4.55. The principal of the land notes outstanding is $2,675,719.54. Of the $10,400,000 land-grant bonds issued, $1,574,000 have been canceled by the Land Department and $731,000 by the trustees, leaving $8,095,000 outstanding.

Blue Earth Valley.

Arrangements are being made to organize a company by this name to build a narrow-gauge road from Mankato, Minn., south to Fort Dodge, Ia., a distance of 120 miles.

Manhattan & Northwestern.

Arrangements have been finally concluded for the iron to lay the track from Manhattan, Kan., northward to the crossing of the Central Branch road at Irving, a distance of about [illegible] miles. The first lot of iron will be shipped from Cleveland August 30.

Raleigh & Augusta.

Work has been resumed on this road from Sanford, N. C., southward. Mr. J. Q. A. Leach, the contractor, commenced grading at Sanford Aug. 20, and others will soon be at work on their sections.

Monadnock.

The proposed lease of this road to the Boston, Barre & Gardner is for 99 years, the rental to be $12,000 the first year, $15,000 the second, and $18,000 per year thereafter. The road is 17 miles long, from Winchenden, Mass., northward to Peterboro, N. H., and it is proposed to extend it northward about 18 miles further to a connection with the Hillsboro Branch of the Concord and Claremont road, thus giving the Boston, Barre & Gardner a connection with Concord.

South Branch.

Work on this road is progressing steadily and the road is nearly completed. It extends from Green Spring Run, on the Baltimore & Ohio, 14 miles east of Cumberland, southward 16 miles to Romney, W. Va. It has been proposed to build a branch from Hanging Rock, 12 miles south of Green Spring Run, east by way of Damphing Hollow and Johnson's Creek to the Baltimore & Ohio at New Creek, which would make a loop line from Green Spring to New Creek, 25 miles long, or 11 miles shorter than the present line by Cumberland.

Nevada County.

The surveys and estimates for this road have been completed. The length of the line from Colfax, Cal., to Nevada city 22.3 miles and the estimated cost, including equipment, $411,133, or $18,436 per mile. The directors resolved not to begin work until $300,000 has been subscribed. In case that sum is not secured by September 1, a meeting is to be called to consider the question of abandoning the enterprise.

Louisville, Paducah & Southwestern.

The President of this company has made the following statement of the company's condition in a communication to the Louisville City Council:

Stock	$4,175,650 00
First mortgage, main line	3,000,000 00
" " Louisville Extension	78,000 00
Bills payable	935,426 92
Pay rolls and vouchers unpaid	123,914 07
Due contractors	54,067 73
Total liabilities	$8,367,058 72

The company holds $822,000 of the Louisville Extension bonds, which are placed as collateral, and the sale of which will reduce the floating debt by the amount of their proceeds.

The road is now doing all the business possible with the present equipment. An increase of equipment would enable it to secure a large additional traffic. It is anticipated that the road will earn a considerable surplus over its interest obligations.

The whole funded debt, including bonds pledged, is $16,883 per mile, the interest charge being $1,351 per mile. The whole floating debt amounts to $4,820 per mile.

Oil Creek & Allegheny River.

A meeting of the consolidated mortgage bondholders was held in Philadelphia August 18, at which a plan of settlement arranged by Mr. John Scott, President of the Allegheny Valley Company (which holds a controlling interest in the stock), was presented. The plan provides for a foreclosure and reorganization on the following basis: First mortgage (on which no default has been made) to remain as now $2,580,000. Consolidated mortgage bonds, $1,100,000, to be converted into preferred stock and floating debt, $368,000 to be second preferred stock, common stock remaining at its present amount, $4,959,000.

There was a strong opposition to this plan, and after a long discussion the meeting resolved to appoint a committee of five to confer with the trustees, W. G Moorhead and W. G. Fargo, and to prepare a report on the operations of the road and affairs of the company, such report to be submitted to a meeting to be held October 13. It was also resolved that the Receiver ought not to be allowed to pay coupons of the leased Union & Titusville road while the consolidated coupons remained unpaid.

Thomas S. Fernon, Thomas Dudley, J. W. Miffley, J. Ritter and Joseph Hahn were appointed the Committee, and given power to fill vacancies.

Green Bay & Minnesota.

Some time ago this company began suit to recover the amount of his subscription from one of the subscribers to the bonds which the road was to have received from Winona, Minn., but which was never paid. The defendant put in a demurrer which has just been overruled, and now the company has begun suit against a large number of the other subscribers.

Illinois & St. Louis Bridge.

An agreement has been concluded between the Bridge Company and the various railroad companies interested, and trains will begin running across the bridge regularly about September 1. The Bridge Company undertakes to haul all freight across with its own motive power, and to provide warehouse room in St. Louis. The Union Railway & Transit Company has contracted with the Bridge Company to furnish the necessary locomotives and also the side-tracks and warehouses in St. Louis. Extensive buildings are to be put up, and meantime temporary platforms and sheds are provided for freight, and also temporary passenger accommodations. The passenger depot will be at Eleventh and Poplar street for the present, and there will also be a local depot at Main street. The permanent union depot is to be between Twelfth and Fourteenth streets on Poplar, and work on it will be begun soon.

The tariff of charges for business crossing the bridge is as follows, and the rates (except for passengers) embrace all charges for transportation, delivery, warehousing, etc.:

SCHEDULE A.

For live stock of all kinds, coal, tobacco, grain, flour, stone, brick, pig-iron, iron ore, railroad iron, cotton, German clay and soda ash, $5 per car.

SCHEDULE B.

For lumber, salt, lime, cement, hay, ice, bar iron, machinery, agricultural implements and all other articles not herein mentioned, $6 per car.

SCHEDULE C.

For coffee, sugar and molasses, four cents per 100 pounds.

SCHEDULE D.

For general merchandise, five cents per 100 pounds.

SCHEDULE E.

For freight and passenger cars hauled as freight, $5 per car.

SCHEDULE F.

For new locomotives hauled as freight, $20.

SCHEDULE G.

For passengers, ten cents each.

SCHEDULE H.

For express goods in baggage or express cars, five cents per 100 pounds.

This makes an expense of from 50 cents to $1 per ton for freight for the crossing and terminal expense, and on the lowest class of goods will add 2½ cents per hundred to the cost of transportation to the river; on the highest class 5 cents, which is about 5 per cent. of the usual charge from New York to Chicago.

Forced Sales of Securities.

In New York August 26, at auction sale, $5,000 New York & Oswego Midland Western Extension Bonds sold for $6 per $1,000 bond; $29,000 New York and Oswego Midland convertible bonds, $11 per bond; 68 shares Milwaukee, Lake Shore & Western preferred stock, 10 cents per share. At the same time $137,000 Delaware & Hudson Canal Company's 7 per cent. bonds were sold at prices varying from 102⅛ to 104.

Cincinnati Southern.

Mr. Lovett, Consulting Engineer of this road, informs us that some of the statements made in the number of August 22 with regard to the proposed Ohio River bridge are erroneous. The steamboat men did not desire the channel span near the Kentucky shore; the railroad men have not located it near the Ohio shore, and all the witnesses did not favor a location 600 feet above the one chosen.

The statement in question was made on the authority of the Pittsburgh *Commercial*, and was the one telegraphed from Cincinnati to the press generally.

Columbus, Chicago & Indiana Central.

In the suit of James Pullan, trustee, against the Cincinnati & Chicago Air Line and others, the Court orders that all holders of the bonds of 1852 issued by the Newcastle & Richmond Company present their bonds for allowance of their claims to the Clerk of the United States Circuit Court in Indianapolis by October 5, 1874. Failing to do so, they will forfeit all share in the proceeds of the suit and judgment.

Contributions.

Reporting Locomotive Performance.

To the Editor of the Railroad Gazette:

I have but recently had time to read your very excellent article on Locomotive Reports and Performance, and my impression is your foot-pound or mile-ton system would work, providing it could be carried out to the letter; but the enormous detail attending an accurate account of performance by this particular plan would, I fear, make it impracticable. Just think, for instance, of a local freight train distributing 75 to 100 cars in one day on a division only 100 miles long. Some of these cars loaded, others half loaded, some empty, weighing 20,000 lbs., others 17,000 lbs. more or less. Many of the side-tracks often have from 10 to 40 standing cars, which frequently have to be switched more or less, in order to place a single car in a convenient locality to be loaded or unloaded. In fact the labor of switching a local train is sometimes almost equal to the labor of hauling it the entire length of the road.

In cases of this kind your method of calculation cannot, I think, be made sufficiently accurate. The labor of switching engines, as well as the service of those employed on work trains, would be equally difficult to reach by your plan. I agree with you in the fact that the foot-pound, or mile-ton, could be easily calculated on through business, but for all miscellaneous business, I think it would be very difficult. And it appears to me that a solution of the question cannot be reached until we devise some simple system of calculating the power or actual work performed by a locomotive which is equally applicable to all cases, under any and all circumstances.

I think you are on the right track, and believe, as I understand you do, that the problem can only be worked out by the use of a dynomometer in some shape or other. The only practicable way, in my opinion, to use the dynomometer is to place it between the engine and tender to remain there permanently, and so arranged as to register automatically every foot-pound or mile-ton hauled within a given time. It should also be arranged so as to register the backing as well as the drawing strains, then at the end of each trip take the average registration as indicated by the dynomometer and multiply by the number of miles or feet run, and we would have the actual work performed in mile-tons or foot-pounds. This would apply to switching as well as all other kinds of service, except *pushing*, which in itself is a dangerous practice, and should not be allowed where it can be avoided.

An Example of Crossing Signals.

August 20, 1874.

To the Editor of the Railroad Gazette:

An article in your issue of August 15, representing how railroad signals at junctions, etc., *should be* arranged, caused me to try to describe how such signals *are* on one of the leading roads of the country, and show how much they lack of being up to the standard described by your correspondent. The semaphore under consideration is a mast about 25 feet in height, with an arm which can be raised and lowered, also a lantern on top, which by the same movement is changed from white to red, or *vice versa*. It stands at the junction of two tracks, at the end of quite a large railroad yard. But two positions of the arm or lantern are required; the arm is usually kept perpendicular, and the light facing incoming trains white; when in this position the signals allow the trains of one road to arrive *and depart*, at the same time holding trains on the other track.

When the arm is horizontal and the light red, it changes the right of way to the other track.

No arrangement under present rules can be made to hold trains on both tracks at once with the semaphore (a proceeding often necessary), and no difference whatever is made in the signals for trains arriving and departing on same track.

Forty-four regular trains pass this semaphore daily except Sunday, and switch engines are almost continually running by it.

One day and one night man attend the signals and the neighboring switches (four in number) at a salary of $50 per month each.

E. C. Centric.

Estimating Locomotive Performance.

Chicago, August 9, 1874.

To the Editor of the Railroad Gazette:

I read your editorial on "Locomotive Reports and Performance," in the Railroad Gazette of July 25, wherein you suggest a system of reducing "all locomotive service to foot-pounds of work done," or to "mile-pounds."

There is great necessity at the present time for a uniform system of locomotive reports, but the basis of this system must be a uniform method of computing the mileage of engines. If one road allows 6 miles an hour for switching engines, another 8 miles and another 10, how can a comparison be made? If one road allows its engines in freight service just the actual miles made between the terminal points of the section or run, while another road allows its engines an additional 6, 8, or 10 miles per hour for the time they are employed in switching at the stations on the line of road, how can you make a comparison? Or if some roads allow 6, 8 or 10 miles per hour for detentions under steam, while other roads allow no mileage for detentions, comparisons are not to

be made, or if made are not worth the paper on which the reports are printed.

To give value to locomotive reports mileage must be computed in a uniform manner, and at present this is not done. For the information of the companies publishing the reports, they may be valuable now, but for comparisons between different roads they are valueless.

I have before me the June locomotive report of a leading road in Missouri, also the June report of a road running east from Chicago, and from each I quote the miles run to one ton of coal by the switching engines. On the first mentioned the figures are 43.4, 30.7, 41.8, 41.5, 50.4, 47.8, 42.8, 43.5, 40.6 and 40 miles. On the last-mentioned road they are given as follows: 125, 107.3, 167.1, 152.7, 96.7, 119.6, 100.4, 126, 115.8, 122.2, 109, 115.1, 133, 118.1, 124.7, 119.8 and 117.4 miles.

You will perceive that on one road the miles per ton of coal are more than double what they are on the other, for switching engines. From this it does not follow that one set of engines *ran* twice as many miles per ton of coal as the other, but simply that they are allowed twice as many miles for doing equal amounts of work.

The simplest way to reduce the cost per mile run (on paper) of engines is to add fictitious miles. Do not understand me as saying that it is ever done! I suggest that it is the simplest way to economize (on paper).

Last May we ran an engine light, or without train, from Chicago to Champaign, a distance of 128 miles, and found she averaged 95.95 miles per ton; the engine has 15 × 22-inch cylinders and 5-feet wheels. In July last a 14½ × 22-inch cylinder engine, with 5-feet wheel, was run light the same distance, and averaged 102.22 miles per ton of coal. In each case the coal was weighed carefully.

From these experiments it is fair to conclude that an engine engaged in any service (except standing on a side-track) will not make the mileage reported in the statement of one road alluded to herein.

In determining the general average performance of all engines on a road, the switching engines are included; and if their mileage is allowed too liberally, their "average miles" per ton of coal is too high, and cost of repairs, etc., per mile too low, and of course the general average is proportionately affected by the error.

Now, statistics are an evil if they do not have facts for a foundation, and as miles allowed switching engines are imaginary miles, or "constructive," as some call them, I suggest that they should not be taken into consideration in preparing reports of performance of locomotives. If they are continued in general use in these reports, then a uniform system of computing the miles should be adopted by some railway association which has the power to enforce the system. I remember seeing a report, a few months ago, in which an engine had run 2,240 miles, and was charged with one ton of coal, and in the proper column she was credited with having run 2,240 miles per ton.

A serious objection to changing the system of computing the mileage of engines on any road is the fact that it precludes comparisons, *in detail*, between years preceding and those succeeding the change. I think the advantages of uniformity will more than compensate for the inconveniences in not making these detailed comparisons for a year or two.

It seems to me that your system of reducing "all locomotive service to foot-pounds of work done" will be hard to apply in practice. The grades, curves, good or bad condition of track, good or bad state of weather, good or bad condition of cars, and the gauge to which the car wheels are pressed on the axles, all must be taken into consideration. I have noticed on a 4 ft. 8½ in. gauge road that 25 or 26 loaded cars, with wheels pressed on to suit the compromise gauge, will pull as hard as 30 loaded cars with wheels pressed on to suit the 4 ft. 8½ in. gauge. It is possible that the exact value in pounds of these different elements can be obtained; but I submit that it is a difficult problem, and when solved is equally as difficult to apply in practice in the manner suggested by you.

Besides a uniform system in computing the engine mileage there should be a uniformity in the items of expense charged to repairs of engines. A road which charges rebuilding, superintendence, teaming, etc., etc., to repairs of engines should not be compared as to cost of repairs per mile run with a road which charges these items to some other account. If an engine is put out of service entirely, and another is built to replace it, the cost should be charged to repairs of engines; but if that amount is placed in some other account it is evident that the average cost of repairs per mile run will be less than if "repairs of engines" stand the expense of the rebuilding.

In the matter of oil consumed by engines, I notice that some roads do not include the oil used in headlights, while others do. Now it is unfair to compare the average miles run to a pint or quart of oil on two roads, if one includes headlight oil and the other excludes it in making out the locomotive report.

It seems to me that railway managers should insist on having reliable statistics of the performance of locomotives, and that the method of preparing them should be uniform on all roads—certainly on all important ones—in every particular as to allowing the engine mileage, and the division of accounts pertaining to the Locomotive Department.

E. T. Jeffery.

Coal Dust as Locomotive Fuel.

To the Editor of the Railroad Gazette:

The recent adaptation of minutely pulverized coal as a fuel to the rotary puddling machine, by Mr. Crampton, at the Woolwich Arsenal, England, calls for careful attention on the part of all persons who use coal in large quantities for any purpose.

While it may be too early to say that this fuel has been perfectly adapted to this or similar uses, it certainly is not too early to say that it gives abundant promise of affording a means of solving some problems that try the patience, and the ingenuity as well, of our railroad men.

It cannot be denied that a gentle gas flame is the thing to heat boilers with if it only can be had of sufficient intensity, and within the prescribed limits of cost and convenience of management. It is very doubtful if gas can ever be brought into locomotive fire-boxes at any cost—even if it could be had for nothing—since its bulk is so great in proportion to its heating capacity; but, as experience seems to show that this minutely pulverized coal gives a flame that may fairly be called a gas flame, it is fully worth while to inquire whether it cannot be found practicable to introduce the use of powdered coal into locomotive practice.

It is not our purpose at this moment to go into the details that must be carefully and patiently worked out to make the idea a thorough and perfect success, but simply to point out the advantages that would result from its use.

Among these may be named the certain reduction on many roads of the cost of fuel since the finer grades of most coals could at once be introduced; the reduced wear and tear of the fire-box and other parts at present exposed to the fierce local heat of the burning coal, and to the abrasion of the flying cinders; the elimination of the present grate and ash-pan, or its continuance in a modified and reduced form; the greater ease of management of the fire after the machinery for supplying the powder had been perfected, and probably a very important relief to be experienced by passengers from the coarse and sharp cinders that now so often come rattling around the car tops and in at the windows.

Of the difficulties in the way of the successful use of powdered coal, we do not now speak, reserving some suggestions on that topic for the future, both as to what may have been done, and what will need to be done to accomplish the proposed object. It is certain, however, that the principles underlying the largely successful use of coal in this form for puddling deserve the studious attention of our railroad men.

Pittsburgh.

August 20, 1874.

[We may add that it has long been known that, theoretically, coal can be consumed much more perfectly by burning it in the form of dust than if used in the ordinary way. Messrs. Whelpley & Storer, of Boston, have been experimenting for several years past and have applied it successfully to stationary boilers. Their system was in use, to our knowledge, for months at Chickering's piano factory in Boston; whether it is still employed there, we are not able to say. Its use will depend entirely on the success with which the practical difficulties of employing it are overcome. These are very much greater, we think, than our correspondent imagines them to be.—Editor Railroad Gazette.]

Progress of Narrow Gauge Railroads.

Philadelphia, August 22, 1874.

To the Editor of the Railroad Gazette:

Your editorial of June 20 entitled "The Narrow Gauge Fallacy" has led me to collect some statistics from the narrow-gauge roads in operation, viz.: roads having a width between the rails of 3 ft. 6 in. and under, and I append a table of roads showing an aggregate amount of narrow-gauge track laid in the United States of 1,233 miles. To this may be justly added 380 miles, the narrow-gauge mileage of the British Provinces, making a total amount of 1,613 miles laid and in operation in North America as specified below. The completion of these roads embraces the construction of 3,657 miles additional, and from another table it will be seen that their construction has already commenced:

Name of Road.			Miles built.	Projected mileage
Alameda, Oakland & Piedmont			8	60
American Fork			18	22
Arkansas Central			48	150
Baltimore, Swan Lake & Towsontown			6⅛	6⅛
Bell's Gap			9	9
Bingham Canon			23	23
Cairo & St. Louis			32	150
Central Valley			12	12
Cheraw & Salisbury			23	80
Cherokee			8	8
Chester & Lenoir			25	105
Colorado Central (n. g. div.)			26	41
Crown Point			13	13
Denver & Rio Grande			164	870
Denver South Park & Pacific			15	
Des Moines & Minnesota			30	160
East Broad Top			25	30
Galena & Southern Wisconsin			30	110
Golden & South Platte			20	20
Grafton			3	3
Iowa Eastern			20	183
Kansas Central			56	550
Kansas City, Wyandotte & Northwestern			10	240
Kaighn's Point, Gloucester City & Mt. Ephraim			2¾	2¾
Lawrenceville & Evergreen			2⅛	2⅛
Louisville, Harrod's Creek & Westport			5	28
Martha's Vineyard			12	12
Memphis Branch			5	17
Memphis & Raleigh			10	10
Mineral Range			13	100
Monterey & Salinas Valley			18	18
Montrose			25	25
Natchez, Jackson & Columbus			12	180
North Pacific Coast			10	250
North & South of Georgia			35	135
Okolona & Grenada			20	20
Painesville & Youngstown			50	65
Palisade & Eureka			25	81
Parker & Karns City			10	10
Peachbottom			25	65
Peakskill Valley			5⅛	5⅛
Pioche & Bullionville			18	18
Ripley			26	36
Rio Grande			22	22
San Luis Obispo			9	9
Santa Cruz			8	25
South Branch			16	51
Summit County			9	9
Tuskegee			5⅛	30
Toledo & Maumee			10	10
Utah Northern			70	160
Carried forward			1,163	4,243
Brought forward			1,163	4,243
Vicksburg & Ship Island			10	180
Walla Walla			20	20
Wasatch & Jordan Valley			12	16
Worcester & Shrewsbury			3	3
At Johnstown, Pa			25	25
			1,233	4,487
New Brunswick	78	170		
Prince Edward's Island	50	196		
Toronto, Grey & Bruce	165	200		
Toronto & Nipissing	87	218		
			380	784
			1,613	5,271

Before this appears in print several of the following roads will have completed sections of their line, which would considerably swell the total here given:

	Mileage under construction.
Arkansas Central	86
Cairo & St. Louis	58
Chester & Lenoir	75
Denver & Rio Grande	50
Iowa Eastern	20
Kansas City, Wyandotte & Northwestern	40
Memphis Branch	12
North Pacific Coast	90
Painesville & Youngstown	14
Santa Cruz	15
Utah Northern	90
Vicksburg & Ship Island	160

In addition to the above-named roads a large number are under active construction, and their completion may be looked for at no distant day. Space forbids me enumerating but a few:

Big Sandy & Pound Gap.
Butler & Millerstown.
Caledonia & Sumner.
Duck River.
Greenville & Paint Rock.
Green Bay, Wabasha & Faribault.
Nashville & Vicksburg.
Olympia.
St. Louis & Florissant.
Stockton & Ione.
Santa Rosa Branch.
Washington, St. Louis & Cincinnati.
Utah Western.

I cannot agree with the tenor of your argument against the narrow gauge, neither can I agree with your deductions.

It is not simply because the rails are three feet apart that therefore the cars weigh less, but because they are built lighter, and therefore carry a much greater paying weight in proportion to dead weight than they would if built as heavy and cumbrous as those of the broad gauge. Further, the narrow-gauge movement aims at a more thorough economical operating of its line. Witness the Denver & Rio Grande Railway, which for the year ending December 31, 1873, made 49⅝ per cent. net earnings. The Mineral Range, for the eight months ending May, 1874, 41 per cent.; the Parker & Karns City write that they consider their road an entire success, and many other roads have expressed their confidence in a three-feet gauge.

It would be singular if all the engineers and eminent men who have given the subject their attention should be in error, and that finally the fallacy were demonstrated. At present, however, it cannot be considered as such, since various roads in operation have shown that they can entirely fulfill all the calls made upon them, and in consequence of this fresh organizations are springing into being.

With regard to the last paragraph in your editorial, the writer, at the expense of some labor, has compared the grades and curves of broad and narrow-gauge roads:

On the Colorado Central there are curves of 173 feet radius on a grade, the maximum grade being 190 feet to the mile.

On the East Broadtop the maximum curve has a radius of 207 feet.

On the Painesville & Youngstown there is a grade of 82 feet for two miles and at another place 60 feet for three miles. The engines weigh 17½ tons and have six driving-wheels. The net earnings are 35 per cent., and it is very certain that an ordinary road would not be able to pay expenses.

On the Pittsburgh & Castle Shannon there is a curve with a radius of only 125 feet, and on the Parker & Karns City one of 47° (122 feet radius). The steepest grade I have heard of is on the Wasatch & Jordan Valley, a mineral road in Utah, viz.: 560 feet to the mile.

A great number of roads could be named where the grades far exceed the maximum laid down by Congress.

The weight of rail most used by narrow-gauge railways is 30 to 35 lbs. to the yard. This has been found heavy enough, although two or three roads use 45 and 50 lb. iron.

The weight of locomotives varies exceedingly, the nature of the traffic and line of road influencing it considerably; between 7 and 20 tons may be taken as the limits.

Admitted that broad-gauge rolling stock could be built as light as that used on narrow-gauge roads, how would it stand the concussion when made up, or in collision with the cars now used? True, break of gauge would have been overcome, but at what expense would be only found out after the experiment. In conclusion, I quote from a letter from the Baldwin Locomotive Works:

"Thus far in 1874 (July) of the engines built and in progress 26 per cent. are narrow-gauge. This increase of 16 per cent. over last year is not, however, indicative of the general narrow-gauge business. The panic has not affected it as much as wide-gauge, as the increase of orders for power over wide-gauge roads shows a steady improvement in narrow-gauge business, while the wide-gauge has shown considerable decrease."

Howard Fleming.

[We understand our correspondent to call in question our intimation that the narrow-gauge fever has subsided, and to advance in proof of the growing favor of this kind of railroad the statistics given above.

As for the statement of mileage, that of "projected

mileage" might as well be left out. There are probably 50,000 miles or more of "projected roads" in the United States, and "work has been begun," that is more or less grading has been done, on a very large part of them, and the company which has less than a mile graded of its "projected" line of a thousand miles does not hesitate to say that "the prosecution of the work to an early completion has been commenced." There is no prospect whatever that two-thirds of Mr. Fleming's projected lines will ever be completed. Doubtless there are people who hope to complete them, but if that is basis enough, we will make up ten times that mileage in roads of standard-gauge equally "projected."

In the list of the roads completed there are some errors. The Vicksburg & Ship Island, with 10 miles completed and 180 projected, is of standard gauge. The Bingham Canon is 16, not 23, miles long. The Cheraw & Salisbury is not built. The Chester & Lenoir is 22, not 25, miles long, and is not now, we believe, of narrow gauge. The part completed was built about 1855, of standard gauge, and was known as the King's Mountain Railroad until last year, when a project for an extension of narrow gauge was made, in connection with which the gauge of the old road was to be changed. We have not heard that it has been changed as yet. The completed part of the East Broad Top roads is not 25 miles long, but 12. There are no rails yet on the Galena & Southern Wisconsin, nor on the Golden & South Platte. The Monterey & Selinas Valley is recently organized and has no road as yet. The North & South of Georgia has 20 instead of 35 miles of track. The Okolona & Grenada has no track, or but very little. The San Luis Obispo, the Santa Cruz and the South Branch have hardly begun tracklaying yet, with the exception perhaps of the latter. The roads mentioned as at Johnstown, Pa., must be private roads belonging to mines and manufactories, and if such are to be counted probably some hundreds of miles can be found in the country which have been worked for years.

Tabulating the mileage given as built which is not built, we have the following:

	Miles.		Miles.
Bingham Canon	7	North & South of Georgia	15
Cheraw & Salisbury	23	Okolona & Grenada	20
Chester & Lenoir	25	San Luis Obispo	9
East Broad Top	13	Santa Cruz	8
Galena & Southern Wisconsin	30	South Branch	16
Golden & South Platte	20	Vicksburg & Ship Island	10
Monterey & Salinas Valley	18		
Total			214

This is more than one-sixth of the mileage reported completed by Mr. Fleming.

As for the relative economy in working roads of the different gauges, we must have more detailed reports before we have any materials for a comparison. The statements of proportion of working expenses to receipts which Mr. Fleming adduces as proof of the economy of working narrow-gauge roads is no evidence at all. It is true that the percentage of expenses is reduced by making the latter small, but it is also reduced by *making the charges large*. The company which charges three dollars for transportation which costs it two, finds its working expenses 66⅔ per cent., but if it charges four dollars for the same work the proportion of expenses is reduced to 50 per cent. According to the report of the Denver & Rio Grande Railway Company for 1873, its average receipt per ton per mile was 5.93 cents, and per passenger per mile 7.97 cents. With working expenses at 50 per cent. this would give 2.96 cents per ton per mile and 3.98 cents per passenger per mile as the *cost* of doing the work on this narrow-gauge road—certainly not an example of cheapness. It is true that the thinness of the traffic is a cause of dear working, but we can compare with standard-gauge roads of a similar traffic, and the cost per mile is to some extent a gauge of the economy of operation of a road. We are not able to compare the Denver & Rio Grande figures with those of a similar line, as we have no reports from those similarly situated as regards both thinness of traffic and high cost of labor and materials; but there certainly can be very few roads in America where the cost is so great.

No degree of absolute prosperity in a narrow-gauge railroad is proof that its gauge is better than the standard. We never have said, and certainly never shall say, that a narrow-gauge railroad may not be useful to the community which it serves and profitable to its proprietors. We will also say that it is entirely probable that a light narrow-gauge railroad, like those built recently in this country, might succeed in earning a fair interest on the money invested in it where an ordinary standard-gauge railroad, like nearly all those in this country used for both freight and passenger traffic, would fail. We do not deny that a light railroad is cheaper than a heavy one, nor that a light railroad has its uses, nor even that a light narrow-gauge is not often vastly better than no road. What we have continually affirmed and urged as of prime importance is the fact that a light standard-gauge road is in many respects better than one of narrow-gauge—in a developing country not isolated from the standard-gauge system very much better—and at the same time just as cheap.

"It would be singular if all the engineers and eminent men who have given the subject their attention should be in error," says Mr. Fleming. Very true. But so far as our information goes—and we have collected it diligently since the narrow-gauge discussion begun from more sources than are accessible to most men—few eminent railroad men who have given the subject their attention favor the narrow gauge. Half-a-dozen English engineers of real eminence have indorsed certain schemes for narrow-gauge railroads, but the sentiment is overwhelmingly in the other direction, and in this country if we were called upon to name the eminent engineers who believe in the narrow gauge, the list would be very short.

There has been this year comparatively a large amount of narrow-gauge railroad constructed. There are, however, and have been for two years, comparatively few new narrow-gauge projects, except in two or three sections of the country where there is something like a narrow-gauge system, most of them mining roads—not roads in mines but roads to carry ore from and supplies to mines. But it is reasonable enough that people should build light and cheap roads when they can't get money enough to pay for heavy and costly ones, and the country as a whole does not know of any other cheap railroad than the narrow gauge.

Mr. Fleming says "it is not simply because the rails are three feet apart, that therefore the cars weigh less, but because they are built lighter;" to which we are compelled to reply by asking *why* cars can be built light for the one gauge and not for the other? What we have asserted repeatedly is that cars can be built just as light for the standard gauge as for roads the rails of which are near together. Neither Mr. Fleming nor any of the other advocates of the narrow gauge have ever met this question fairly, and as their whole argument rests on it, it certainly is worthy of their consideration.

With reference to curves, it is only necessary to say that the elevated road in New York has curves of 56 feet radius over which they run many trains regularly every day. The road is of 5 feet gauge.

Of grades it may be said that it is hard to understand why they may be worked at a steeper inclination on one gauge than on another. The same law of gravitation governs the resistance of cars and adhesion of locomotives on one as on the other, and on a grade of 560 feet to a mile a locomotive could do very little more than pull its own weight. On the road referred to some additional help is needed besides the friction of the driving wheels to the rails to draw up the train. If grades operated by such methods are to be quoted in favor of the narrow gauge, we will cite in favor of the other side many wide-gauge roads with grades of 5,280 feet to the mile, of which we have one just outside our office door, only we call them elevators here and not railroads, and depend upon a wire rope and not the adhesion of a locomotive to draw us up.—EDITOR RAILROAD GAZETTE.]

Elevation of Curves—Cleanliness, Etc.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is highly gratifying to any one who takes an interest in railroad matters to notice the more than ordinary attention that is being given to the elevation of the outer rail on curves. Although there is yet a vast difference of opinion among engineers and roadmasters on this subject, the belief is fast gaining ground that it has been the practice on most roads to give too great elevation for safety and economy. Indeed there are those "well up" in the engineering profession who argue that it is preferable to *lower* the outer rail than to elevate it. While a few are advocates of this ridiculous idea, others are content with the more reasonable "departure" of laying curves level. These facts are mentioned here to show that absurd ideas will sometimes originate in high places and are likely to cause mischief by being put in practice by those who have no opinions of their own and who place unbounded confidence in the soundness of views advanced by certain "authorities." These absurd ideas usually originate in the office, and their truth or error is never demonstrated by actual practice. There are engineers, however, who use *practice* to test the correctness of their *theories*, and such are the really progressive men of the age.

A somewhat extended tour of observation has given the writer the means of arriving at some *facts* regarding the proper elevation of curves. I find it to be the practice on some roads to leave the degree of elevation to the section men, they putting them up according to *taste*. The consequence is that some curves are nearly "flat" or level, while others are "stuck clear up," and cars will pass around some of them very smoothly at high rates of speed, while on others the oscillation is fearful. Recent observation discloses the fact that on a curve *properly* elevated there is *no oscillation*, however great the speed, providing always the track is in good surface and line. If the elevation is too great the wheel flanges will be thrown against the inner rail with great force at high velocities. This may be accounted for in various ways.

One prominent engineer charges it to the cone of the wheels and claims that the coning of wheels is an erroneous practice. This needs further investigation before mechanics will consent to drop the cone, the prevailing opinion being that the plan is correct. The idea is that in passing around a curve the larger diameter of the wheel treads the rail on the outer side, while that on the inner, having a less distance to travel, runs on its smaller diameter, which seems to accord with both theory and practice. The evil ascribed to the cone as producing oscillation is doubtless chargeable to imperfections in the track. This is apparent from the fact that *there is no oscillation on a perfect track on curves.* In running at high velocities on curves a slight imperfection in the line has a tendency to throw the flange against the inner rail, which of course puts the inner wheel on its largest diameter on the *short side of the curve, where it should not be.* The reaction of the powerful side thrust, together with the natural tendency of the cars to fall on the outer rail, brings it suddenly back to its former bearing, when there is another reaction, which is greatly assisted by an excessive elevation of the outer rail by the force of gravity. Thus we see that by the combined action of gravity, centrifugal force and momentum, aided by imperfection in the permanent way, oscillation will continue entirely around the curve when the wheel is once thrown from its proper place on the rail by a single imperfection in the track on first encountering the curve, although the rest of the curve may be in perfect condition. The same imperfection in the permanent way that will throw the flanges against the inner rail on an elevated curve will do the same thing on a "flat" curve, but with somewhat diminished force, owing to the lack of aid from gravity, as in the case of the elevated rail. But while the inward end thrust is made more forcible by the action of gravity on the elevated curve, that is to say by its (the axle) running down-hill, the reaction on the flat curve is greater and throws the wheel flange against the outer rail with greater force, as the motion is on a plane instead of on an incline or uphill. In this way the danger of derailment is far greater on the flat than on the elevated curve. A defective joint, a worn flange, or any slight imperfection, may cause the wheel to mount by the undue force with which the wheel flange is thrown against the outer rail by the centrifugal force and reaction above mentioned. As the outer rail is the *guide* for the wheels, it is important that it be kept in a condition as nearly perfect as possible, both in regard to its surface and line as well as its elevation. It is also noticeable that on most roads the rails are not sufficiently bent on sharp curves, which causes excessive oscillation and wear, and this should receive greater attention than is usually the case. Some of the best put up curves in the country may be found on the Atlantic & Great Western road, under the direction of Mr. Charles Latimer, Chief Engineer. Mr. Latimer has given the subject special attention, and after close observation and experiment has had his curves put up for a maximum velocity of 30 miles per hour, which, with an elevation of ¾ inch to a degree, seems to reach perfection on a gauge of six feet. This degree of elevation works well at much higher velocities. The writer passed around 8° curves at 50 miles an hour, and no swaying, swinging, or oscillation, or pounding was perceptible. Nor was there any sensation of the raising of one side of the coach as is usual on curves, and there was nothing in the motion to indicate that the train was on a curve. Perhaps no American engineer has taken more pains to arrive at perfection in the construction and maintenance of permanent way than Mr. Latimer. His method of doing business is full of labor and activity, but his labor has been well rewarded, and the public are greatly indebted to him for the safety and comfort they enjoy while riding over the 600 miles of road under his charge.

Below are some of Mr. Latimer's plans of operation, and if all the engineers in the country took an equal interest in similar matters the cost of transportation would be greatly reduced and the public could travel with far greater safety and comfort than at present.

He marks the degree of curvature at the P. C. at every curve on the line, and the section foremen are instructed to elevate the outer rail ¾ of an inch to a degree. He also provides each foreman with a table of ordinates for curving iron, so that the track may be easily kept in perfect line. He uses 3,000 cross-ties to the mile and every tie is spiked, and on sharp curves a cast-iron rail-brace is spiked to the ties to prevent the rails spreading under heavy traffic. All joint fastenings are kept screwed up, which prevents wear of the ends of the rails and adds to safety as well. Section men are required to use the level when surfacing on curves and tangents. This secures perfect elevation on the curves and level track on straight line, which effectually prevents that disagreeable swaying from side to side that may be noticed on most roads. The proper way is to commence the elevation 100 feet before reaching the P. C. This gives an easy approach to the curve, as the wheel flange always follows the higher rail on straight line, and by reaching the curve with a gentle elevation the wheels get their proper position against the outer rail, when they will keep it entirely around the curve unless forced inward by causes above mentioned. The results of Mr. Latimer's labors in this direction are that trains encounter and leave curves at high velocities with no swaying, oscillation or pounding at the journals, and the only indication that passengers have of passing a curve is a sort of agreeable sensation produced by moving rapidly around a circle. In establishing the degree of curvature on the Atlantic & Great Western, the Chief Engineer consulted with enginemen, firemen, conductors, brakemen, track supervisors and section foremen, and made frequent inquiries concerning the movement of trains on certain curves, which, together with his own observation, enabled him to arrive at perfection in putting up his curves. When others take like pains we shall have fewer unexplained derailments, a great reduction in the wear of rails, the life of rolling stock will be prolonged, the cost of transportation reduced with the consequent increase in the value of railroad property.

While on this subject it may not be out of place to mention here that Mr. Latimer's system of maintenance is well calculated to secure perfection, and others will do well to follow suit. The sections on this road are five miles long by actual measurement, and each supervisor has about 50 miles of track under his charge. These men receive their instructions from the Engineer's Office and are expected to give directions to section foremen on all details connected with keeping up track. Printed instructions are furnished all foremen and supervisors, giving them a clear understanding of how all

kinds of work must be performed and the manner of handling all kinds of railroad property to prevent injury and loss to the company. Printed circulars are also issued to all section foremen (or rather blank forms for them to fill out), giving their opinions of the merits of certain kinds of joint fastenings, with their reasons for disapproving of any certain kinds of fixtures, the relative trouble and expense of keeping them in order, also asking their opinion of the best methods of doing certain kinds of work. In this way the engineer is able to arrive at correct conclusions on all matters pertaining to a thorough maintenance and the most economical course to adopt by which the company may receive the full benefit of all expenditures for labor and material.

Another feature in the management of the Atlantic & Great Western that other roads will do well to imitate is the remarkable cleanliness of the entire road and premises. All old scrap of every description has been picked up and put into a huge pile, where it is carefully assorted for the rolling mill. No spikes, nuts, bolts, washers, fish-bars, pieces of rails, broken links or pins, pieces of wrecks of any description, can be seen either on the line of the road or thrown behind car houses or any building, or over the fence or under the platforms out of sight. An untidy section is considered evidence of an incompetent foreman. Notwithstanding that it required much labor and perseverance to gather up the scatterings of years, the company realizes a handsome profit from the expenditure. Indeed, there was money scattered along the road in every conceivable shape, which was not only a useless waste, but gave the road a slovenly, slipshod appearance. There is nothing that will demoralize *anything* quicker than slovenness, and this is especially true of railroad practice. When men are allowed to throw things around in a careless manner, whereby broken materials and filth are permitted to accumulate, they are sure to neglect important duties, and there is an air of general neglect and a frequency of accidents on all roads where these things are practised. As soon as a track-man has his section in a clean, tidy condition, he begins to take a pride in keeping it so, and in doing this he gets a habit of *taking particular notice of everything*, and the consequence is a spirit of *thoroughness* in all matters pertaining to duty. And besides the other evils arising from the habit of letting things lay around loose, it is frequently the cause of much damage by fire. Old ties lying along the road are of a very combustible nature, and they had better be piled and burned as soon as taken out if they cannot be put to any use.

Some one has said that "cleanliness is next to godliness," but there is nothing surer than this: If you desire strict attention to duty by your employes, you must compel tidiness among them. Wm. S. Huntington.

Tests of Materials.

To the Editor of the Railroad Gazette:

Having constant use for the factors of strength of materials of various kinds, and especially of iron and steel, and finding in records of tests—many of which are considered as authoritatively correct—as many variations, almost,as records (though this variation may be due and probably is, partially, to the difference in the qualities of the specimens), I have endeavored, so far as lay within the opportunities I have had, to record with care the results.

This is a problem which presents serious difficulties. It has been my special object to determine constants applicable to large specimens, such as are actually used in construction; and machinery for this purpose requires a very considerable outlay, and each experiment is also very expensive in preparing the specimen and the amount of material destroyed. Again, such apparatus as is ordinarily used is not reliable, as is demonstrated by the fact that hardly any two of them can be found to agree, even approximately. And even when an accurate machine is obtained, I have found great difficulty in recording correctly; there may have been some peculiarity in the action of the specimen under strain that was not observed, or it may have been neglected to record it, and, perhaps, impossible to measure its quantity.

These difficulties and the uncertainty of errors which necessarily attach themselves to human work of this kind led me some years since to devise an arrangement which should record automatically the amounts of strain and resulting action and its direction, at the same time; so that, the machinery being correct, there could be no error in the record, which should be a continuous diagram and which could be filed away for preservation and future examination and comparison, and, taken in connection with the fractured specimen, would at any time furnish the data for the determination of any desired quality in the specimens.

The apparatus with which my investigations have been conducted consists of an horizontal hydraulic cylinder at one end, and connected with it and held in its position apart from the cylinder by two large timbers, one on each side, with a clear space of 28 inches between them, is a cast-iron box or frame containing the weighing levers, which are so delicately balanced as, even when strained to nearly its maximum power, to be affected perceptibly by a very slight change in the amount of strain. These levers have been demonstrated to be very accurate by very careful measurement and by many comparisons with other smaller machines of undoubted accuracy and other tests equally conclusive. The whole apparatus is securely bolted down to heavy masonry. Attached to the ends of the weighing lever and connected with it by a suitable mechanism is a pencil which rises as the strain increases, registering the amount upon a paper secured to a cylinder which is revolved by the extension or compression of the specimen, the apparatus being arranged for either tension or compression. The capacity of the apparatus is 150 tons, and a maximum length of the specimen of 40 feet.

The diagram thus obtained can readily be seen to be a reliable record of the action of the specimen tested. The vertical measurements or ordinates of the curves denote the amount of strain, and the corresponding longitudinal measurements or abscissas the extension or compression of the specimen produced by the strain. At first the diagram rises almost vertical, and the distance of any point, within certain limits, from the vertical being taken with the strain per square inch as obtained from the ordinate of the point will give the modulus of elasticity; the diagram at this portion is very nearly a straight line; being convex towards the line of no strain, the more homogeneous the specimen the nearer does the diagram approximate to a straight line, until the limit of elasticity is reached, when the specimen extends or compresses rapidly and the diagram becomes concave towards the line of no strain, this change of direction being more or less abrupt, depending upon the characteristics of the material and also as to whether the strain be tensile or compressive, but I have seen no case where the point of change was not distinctly indicated. The diagram now continues more or less concave in its general course towards the line of no strain till rupture takes place, when the pencil instantly falls. Sometimes the diagram just previous to final rupture becomes more decidedly concave, indicating the slow tearing asunder of the fibres, ductility and toughness of the material. Since strain into corresponding extension or compression is comparative resilience, the area included within the diagram represents the comparative safety against sudden shocks, the energy of which, in all possible cases, in practice is presumed to be within the limit of elasticity.

I propose in a future article to describe some of these experiments and draw comparisons and conclusions and explain the method of obtaining them, concerning the different qualities, forms and sizes of tension bars and struts. I think the most casual observer cannot but see the value of tests thus recorded, and while we cannot but admire and respect the care and patience of Mr. Kirkaldy, who has furnished to the world one of the great steps and given a great impetus in the search after knowledge of the character of this most important metal, we have a means of going still deeper into this most fascinating and instructive as well as practical study.

The Cheapness of Brakemen.

To the Editor of the Railroad Gazette:

Do you not think that a part of the trouble with the freight-car couplings lies in the fact that freight train brakemen are comparatively so easy to get? In other words, is it not likely that if brakemen were more afraid than they really are of the danger of the life they lead our railroad companies would find themselves compelled to pay far higher wages, and so would be indirectly led to do something or other to reduce this danger?

What the danger really is may be inferred from this, that freight train brakemen are rated for accident insurance with gunpowder makers, and with them are taken at the highest rates alone.

It has been declared indeed by an agent of one of the accident companies that they always expect to lose a risk of this sort, however rarely it may be taken.

What can be done by the railroad companies, or what they ought to be compelled to do, is not the question at this moment, but only how far the willingness of so many of our young men to run these risks for the sake even of the small pay they get causes these couplings to be left, as they are, to fulfill their use in the roughest sort of a way.

A somewhat curious question is opened by this fact that so many are willing to leave an occupation such as that of a farmer, which insures for ten dollars per thousand, and to fill up the occupation of brakeman, which insures at all only at the high figure of twenty-five dollars per thousand, and the total loss of which, though limited to $500, is taken for granted from the start by the insurance companies. Pittsburgo.

Hall's Automatic Electric Railway Signals.

For more than a year there has been in successful operation on the Eastern Railroad a system of automatic electric block signals which seems destined to play an important part in the future running of railways. By the electric block signal trains are run by intervals of space instead of intervals of time. By the latter system it is assumed that after a train has been gone a certain time it has gone a certain distance, and it may be safe to despatch another train over the same line, whereas by the block signal every train is absolutely kept at a safe distance behind its predecessor. Several of the greatest causes of railway accidents are removed by the employment of the electric signal. Head and rear collisions and accidents at grade crossings, switches and drawbridges, are rendered next to impossible. A most important, and to many of our overcrowded railroads an inestimable advantage, is that the capacity of the road may be increased to an enormous extent, for it matters not how many trains there are on a road as long as they are safely kept a certain distance apart.

A railroad may be divided into signal sections or "blocks" of any convenient length; say a mile, two miles, five miles, or even half a mile. The Eastern Railroad is divided into sections of a mile each. At each mile the passenger sees two signal boxes elevated on posts so as to be about on a level with the engineer's eye as he sits at his post. These signal-boxes are round, and have in their centre on each side a little round window, so that when the danger-signal is not set the light shows through from side to side. At night, a reflecting lamp on the opposite side from that toward which the train is going is lighted. The signal is a disk of red cloth—the traditional color for danger—and the cloth being thin the light shows through as it would through stained glass. The signal is operated by what is known as the track machine. The train passing over a rail moves a lever which acts on a piston in an air-tight cylinder placed beside the track. This piston being suddenly thrown up completes an electrical circuit and causes the signal to be raised before the little glass window just as the bells of the fire alarm telegraph are struck. The instructions to engineers are simple enough. Never pass a red signal. A train in passing over the track machine sets the red disk which says "danger" to a following train. At the same time the signal in the other box alluded to, and which is known as the signal of safety or caution, changes from red to white, letting the engineer know that the signal in the box he has just passed has been changed to a signal of danger, and that he may pass safely on. The secondary signal is always about a thousand feet ahead and within sight of the first, so that the engineer can see it as it changes from red to white. The train keeps on under the protection of the signal it has just set, assured that no train will follow until it gets on to the next mile block, where, having set the signal for that division and proceeded about a quarter of a mile beyond, it passes another kind of a track machine known as a letting-down machine. This, by breaking the electric circuit, reverses the signals a mile back and opens that block to coming trains. Thus every train always has its rear guarded by a mile of track between it and its followers. There they stand, a line of silent monitors picketing the track, unfailing, unerring, and pointing out any errors which humanity makes. In summer and winter, be the weather foul or fair, by night and day the red light always tells of danger ahead. Every part entering into the system is as simple and durable as human ingenuity can make it, so that a failure to work is impossible, except under the most extraordinary circumstances; and under no circumstances, even by failure of the battery, or any of the instruments used to do their appointed duty, could an engineer be deceived, or the safety of a train endangered, as the safety or caution signals stand guard over all, and instantly inform the engineer if anything is wrong.

Since the application of the system to the Eastern Railroad several improvements have been made by the inventor, which have made the operation more feasible and reduced the expense about one-half. When the system went into operation, at every primary signal there was a little house in which was kept the battery for working that block. But this entailed a great deal of trouble and expense. The batteries had to be tended to and cleaned once in three weeks, at least, and in the freezing winter weather this was no small job, and it was apt to be slighted. Then there was some trouble from the freezing of the batteries when cold snaps came. But a great improvement was made so that one battery alone could work an entire line, though on the Eastern Railroad there are now two—one at Chelsea, working the line between Boston and Lynn, and one at Salem, working the line between Lynn and Beverly, the latter place being as far as the system yet extends, though it will ultimately be used over the whole line between Boston and Portland. During thunder storms it was found that the lightning would sometimes burn out the electric coils, but that has been prevented by the use of lightning arresters, which carry off safely all surplus electricity. The track machines have also been improved.

On a single-track road, though the principle is the same as that just described, the application is somewhat different. The blocks would be considerably longer, say five miles. A train entering on a block would set a danger signal on the right of the track, thus protecting its rear, and at the same time set a signal on the left of the track, five miles ahead, warning any coming train that the road is occupied. On passing on to the next section a corresponding set of signals is displayed and those it has just left are reversed, showing that the section behind is all right.

To see the practical working of the system one might go to Salem, for instance. The regular passengers over the road know what an important point that is; of the trains that are continually passing to and fro through the great stone railroad station, of the tunnel wide enough for but a single track, and of the several branches which converge there.

Standing on the platform with the station master we hear a gong strike three or four times. "That is the train from Boston," he tells us. "That bells says that it has just passed the signal post a mile away." Just then a bell at the other end of the station begins to ring. "That is the Portland train coming. It is now a mile to the east," we are told; but we don't want it in the station until the Boston train leaves, and we will stop it on the other side of the tunnel." The station-master, our guide, then opens a little box on the wall and touches a signal key. Immediately a bell responds. "That tells us that the danger signal is set. The train will not come in until I reverse the signal. That is what is called the station signal. There is one each side every station, and they are operated from signal keys like these you see. But here comes the Boston train; watch these signals down the track and you will see them change." So we look and see, as the train passes, the first signal change instantly to red, closing the track behind, and the second change to white, opening the track behind. The train arrives and departs, and after it has passed through the tunnel the signal is given which releases the Portland train and lets it come in. A short distance the other side of the tunnel is the junction of the Lawrence branch, and we are told about a signal a short ways down the branch, which trains on the main line operate, notifying branch trains to wait until the former have passed on a safe distance. Just at the entrance to the tunnel we are shown a signal. "That is a track signal," we are told, "but it is also operated from the station. Here come a through freight train, going east, for instance. It does not stop here, but we wish to-day to give it some instructions. We set that signal red, just as if a train had passed it, and the freight stops here in the station.

Having seen the working of the signals at Salem, we take a local train going Bostonward and stop at Revere, where the track to East Boston joins the main line, and are shown how when a train is coming from Boston it sets a signal on the branch, warning trains coming off the branch to wait until it has passed on a mile, and how a train coming off the branch also sets a similar signal on the main track, and how a train stopping at a station is absolutely protected from being run into by a following train on the same track. We are also shown how that, if the junction switch is wrong, it will set danger signals a mile away on either side, which will be displayed until the switch is set right. At Chelsea we are shown the battery-room for the section between Boston and Lynn, and can hear every train as it passes over the track machines all along the road, for each car truck, as it passes by, operates the track machine, and the clicking is thus communicated to the apparatus connecting with the signal wire.

We can tell at what rate of speed the train is going, for if fast the clicks will sound in rapid succession; what kind of a train it is, for the trucks of a freight car are nearer together than those of a passenger car, and the sounds will come at closer intervals; and even can count how many cars there are on the train. Therefore by noticing the trains when they pass by, the exact whereabouts of every train on the road can be thus ascertained.

At Everett we see a crossing where the coming of a train in either direction is communicated to the flagman by the striking of a gong, giving him ample warning to close the gates and avoiding the necessity of the horrible steam whistle. The Railroad Commissioners recognized this fact in their recent decision on the use of steam whistles, when they suggested that the use of the automatic signals would render needless the continuation of the nuisance. On reaching Boston we are shown a model of the application of the system to a draw-bridge, which, when turned, sets signals in both directions in the same manner as in the turning of a switch, and at the same time lets down a board suspended over the track, so that if the engineer did not heed the signal his smoke-stack would be knocked off.

One would think, from the wonderful ingenuity shown, that the inventor had been a trained electrician all his life; but Mr. Hall was formerly a New York merchant, who had his attention turned to the matter by being in a train which was thrown from the track by a misplaced switch. He first invented the switch signal, and from that elaborated the present system.

The Eastern will not long remain the only Boston road which uses the system.—*Boston Advertiser*, *Aug.* 10.